DEPARTMENT OF TRANSPORT

INFORMATION CIRCULARS TO AIR ENGINEERS AND AIRCRAFT OWNERS

JANUARY 1, 1928 TO MARCH 31, 1948

Published by Authority

of

HON. LIONEL CHEVRIER,
Minister of Transport

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Deputy Minister of Transport for Air Services

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FOREWORD

Many of the Information Circulars in this booklet are revised editions of previous circulars, although the original circular numbers have been retained. Recipients of this publication are strongly advised to carefully read all circulars and destroy all copies of the booklet previously issued.

NOTICE

Change of Address

It is important that air engineers and aircraft owners notify this Department promptly of any change of address in order that the delivery of Circulars and other matter may be assured.

Aircraft Accidents

All aircraft accidents shall be reported to the Controller of Civil Aviation as required by Air Regulations 1938, Part VIII. If accidents involve death or injury to passengers, crew or third parties, they shall be reported by telegram. If damage does not extend beyond the aircraft, the accident may be reported by letter. In order that there should be no delay in carrying out the inspection of damaged aircraft or any investigation of the circumstances attending accidents, a copy of the telegram or letter should be sent direct to the District Inspector concerned.

Communications should be addressed to the Controller of Civil Aviation, Department of Transport, No. 3 Temporary Building, Ottawa, Ontario.

Air Regulations

Applications and inquiries relating to air pilot and air engineer certificates and examinations, registration and inspection of aircraft, and interpretation of air regulations should be directed to the District Inspector, Air Regulations, for the district concerned.

Air Regulations Districts

District Inspector, Air Regulations,
420 Federal Building,
325 Granville St.,
Vancouver, B.C. Telephone — P.A. 3377.
(British Columbia and Yukon Territory.)

District Inspector, Air Regulations,
402 Blowey-Henry Building,
Jasper Ave.,
Edmonton, Alta. Telephone — 22858.
(Saskatchewan, Alberta and the Northwest Territories.)

District Inspector, Air Regulations,
717 Dominion Public Bldg.,
Winnipeg, Man. Telephone — 95823.
(Manitoba and Northern Ontario west of the 86th meridian of longitude.)

District Inspector, Air Regulations,
No. 1, Montgomery Ave.,
Postal Station "K",
Toronto 12, Ontario. Telephone — Mohawk 3533.
(That portion of Ontario lying south of the main line of the C.P.R. from Montreal to Sault Ste. Marie and west of the 77th meridian of longitude.)

District Inspector, Air Regulations,
Room 44, Trans-Atlantic Administration Building,
Montreal Airport,
Dorval, P.Q. Telephone — WA7701
(Quebec, east of the 75th meridian of longitude, to include duties in Labrador when required.)

District Inspector, Air Regulations,
Dominion Government Building,
P.O. Box 42,
Moncton, N.B. Telephone — 9611.
(Provinces of Nova Scotia, New Brunswick, and Prince Edward Island, to include duties in the Magdalen Islands when required.)

Airways

Inquiries concerning the inspection, licensing and registration of airports, the investigation, development and maintenance of airports and airways, and matters relating thereto should be directed to the office of the airways district concerned.

Airways Districts

District Inspector, Western Airways,
112 Pacific Bldg.,
Vancouver, B.C. Telephone — Pacific 9929.
(Territory — British Columbia and Yukon Territory.)

District Inspector, Northern Airways,
402 Williamson Building,
Jasper Avenue East,
Edmonton, Alta. Telephone — 22035.
(Territory — Alberta and Northwest Territories, West of the 102nd Meridian.)

District Inspector, Central Airways,
608 Power Building,
Portage Avenue,
Winnipeg, Manitoba. Telephone — 93-358 and 93-359.
(Territory — Saskatchewan, Manitoba, and that part of Northern Ontario lying West of the 84th Meridian (Nagogami, Ontario).)

District Inspector, Southern Airways,
4 Hughson Street S.,
Hamilton, Ontario. Telephone — 7-7821.
(Territory — That part of Ontario lying East of the 84th Meridian (Hearst, Ontario), and West of the 75th Meridian.)

District Inspector, Eastern Airways,
Room 305, Trans-Atlantic Administration Building,
Montreal Airport,
Dorval, P.Q.
(Territory — Province of Quebec, excluding Magdalen Islands, Que., and associated services in Labrador.)

District Inspector, Maritime Airways,
Dominion Government Building,
Moncton, N.B. Telephone — 5984.
(Territory — Provinces of New Brunswick, Nova Scotia, Prince Edward Island, Magdalen Islands, Que., and associated services in Newfoundland.)

Any parts of Canada not included in the above districts will come directly under the Controller of Civil Aviation at Ottawa.

Matters of Policy

Matters of Policy and any subject requiring a decision not already provided for in *Air Regulations 1938, Information Circulars* and other memoranda will be dealt with at Headquarters, Ottawa, and correspondence on such matter may be forwarded through the Branch Office or communicated direct to Ottawa.

DEPARTMENT OF TRANSPORT

Air Services Branch
CIVIL AVIATION DIVISION

INFORMATION CIRCULARS TO AIR ENGINEERS AND AIRCRAFT OWNERS

The following Information Circulars to Air Engineers and Aircraft Owners, remain in force at this date and are reprinted herewith :—

1932: T/5, T/13

1933: T/10

1934: T/7, T/12, T/15, T/21

1936: T/3

1937: T/1, T/8

1938: T/2, T/3, T/5, T/8, T/14, T/19, T/20, T/21, T/22, T/28

1939: T/1, T/3, T/5, T/8, T/14

1940: T/4, T/5

1941: T/1

1942/ T/1, T/2

1945: T/1

1946: T/1, T/2, T/4, T/5

1947: T/1, T/2, T/3, T/4, T/5, T/7

1948: T/1, T/2, T/3, T/4

A number of Technical Information Circulars which have been issued during the past twenty years have been omitted from this book. Many of these are cancelled, others have become obsolete and the information which they contained has been brought up to date in subsequent issues. Others, however, which pertain to the modification of old types of aircraft are still in force but are now seldom referred to and it is not considered necessary to have them republished. Information Circulars pertaining to modification of old types of aircraft may be obtained on application to Headquarters at Ottawa.

A list of enterprises in aircraft manufacture, repair and supply, with the names of approved inspectors, is revised from time to time and copies may also be obtained on application to Headquarters.

Dated at Ottawa, March 31st, 1948.

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1932

T/5/32 13/4/32

AERO ENGINES — SPARK PLUGS

Spark plugs are essential accessories, and the satisfactory operation of an aircraft engine depends, to a considerable degree, on the suitability of the spark plugs for the particular installation.

The type certificate of an engine is issued after its satisfactory performance in an observed test, during which certain types and makes of spark plugs form an essential part of the assembly.

The approved spark plugs are listed in the appropriate handbooks by the engine manufacturers.

The Department will consider an aero engine airworthy only when fitted with serviceable spark plugs of makes and types approved by the manufacturer of the engine.

T/13/32 12/9/32

SEPARATE LOCKING OF TURN BUCKLES

Instances have occurred in which the turn-buckles of twin adjacent control cables have been locked by a single length of locking wire. This practice is dangerous as vibration and relative movement of the cables may lead to failure of the locking wire.

All turn-buckles should be locked individually and any adjacent turn-buckles found locked by one length of locking wire should be unbolted and properly secured.

1933

T/10/33 29/9/33

GIPSY MARK I AND MARK II AND GYPSY MAJOR ENGINES — WOODEN PROPELLERS

Instances have occurred of splitting of above propellers in the region of the boss due to the transmission of part of the propeller torque by the hub bolts instead of entirely by friction at the rear boss face.

Wooden propellers which are or have been in use on these engines are immediately to be removed from the hubs and examined for signs of fracture of the boss, particularly at the rear face in the region of the bolt holes.

Any such propellers showing signs of fracture are to be regarded as unserviceable.

When assembling serviceable propellers and hubs, care must be taken to ensure that the hub bolt nuts are adequately tightened before being locked. In order to maintain the friction drive, the tightness of these nuts is to be checked periodically, and any slackness found is to be taken up. With propellers in frequent use, this periodical check should be made at the end of every 25 hours' flying, while, in the case of new propellers, the tightness of the nuts should be verified during the first 10 hours' flying.

1934

T/7/34 23/2/34

GIPSY MAJOR ENGINES — PROPELLER HUBS *Revised 31/3/48*

An improved design of propeller hub to G.A. drawing No. 1900 has been introduced for use on Gipsy Major engines, and hubs of this design will be fitted to new Gipsy Major engines, commencing with engine number 5434.

The new design differs mainly from the earlier design, which is the standard for Gipsy I, II and III engines, in that the rear flange is appreciably greater in diameter. Other changes have also been incorporated, including a small increase in the diameter of the front flange.

It is found that, in general, a ridge is formed on the boss faces of wooden propellers, irrespective of the engine on which they have been used, as a result of the timber being indented by the hub flanges. Wooden propellers, therefore, which have been used

on Gipsy Major hubs of earlier design and which are required to be fitted to hubs of improved design, are to be examined for signs of indentation of the boss faces. If such indentations are found, the boss faces are to be trued up, preferably by a propeller manufacturer. The finished surfaces should be flat and smooth, and a witness of the original hub flange marking must be left on each face to ensure that it is perpendicular to the axis of the bore. Care should be taken that only the minimum amount of timber is removed. Finally, the trued-up surfaces are to be revarnished.

T/12/34 **31/5/34**
Revised 31/3/48

INTERNAL CORROSION IN STEEL FUSELAGE MEMBERS

1. The attention of all concerned is directed to the possibility of serious corrosion which may occur within steel tube structures, and which may not be apparent externally until penetration of the tube walls has occurred and the structural strength has been very seriously reduced. This corrosion is particularly active when aircraft are used as seaplanes operating from salt water. Lower longerons and cross struts are particularly vulnerable, especially when the fuselage members as a whole are inadequately protected internally and are not sealed against the effects of salt laden air.
2. An incident has recently come to the attention of the Department in which an aircraft with approximately 1,200 hours' flying time had been passed as airworthy by two competent inspectors and three months later, while being reconditioned, was found to be unserviceable because of excessive internal corrosion of the lower longeron. The significant point is that this dangerous condition was not detected by competent inspectors during a normal external inspection and, whereas this condition perhaps to a lesser degree, was present at that time, it was not finally detected until the walls of the tube fell away with the removal of paint during overhaul three months later.
3. Because it is impracticable to determine definitely whether or not the internal surfaces of steel tube structures are adequately protected against corrosion, it must be assumed that under adverse conditions internal corrosion will occur, and adequate precautions must be taken to guard against it.
4. While a definite technique has not been developed, the use of a self-acting, spring loaded centre punch equipped with a small ball point, and applied on suspected members is considered to be capable of useful development. The application of such a punch will not injure a tube which is not badly corroded, but will indicate a faulty member by an easily perceived indentation. To ensure that this procedure is effective, it has been found necessary to apply the punch at points not greater than one-quarter of an inch apart over the area suspected. After prolonged exposure to adverse conditions and at periods not exceeding three years, it is considered advisable to remove sections of suspected tubing and, in particular, the rear sections of the lower longerons for internal inspection.
5. Aircraft with welded steel tube fuselages which have operated at any time as a seaplane on salt water and which are three years old must be considered as particularly liable to this form of corrosion, and such aircraft are to have a portion of the lower fuselage longeron removed for internal examination during the next overhaul, and in any case before renewal of Certificate of Airworthiness.
6. Air engineers and pilots operating aircraft as described in paragraph 5 must at once satisfy themselves as far as is possible by external examination of the tubes that their particular aircraft are airworthy in this respect.

T/15/34 **29/6/34**
Revised 31/3/48

SOLID METAL PROPELLERS — RECONDITIONING

Damaged metal propeller tips may, in many instances, be removed and the ends refinished without material loss of efficiency, provided that the resultant diameter is not reduced beyond 10 per cent of the original, and the refinishing and the balancing are satisfactory.

Operators must satisfy themselves that there is no material economic loss of performance, and still must ensure that minimum airworthiness performance requirements are fulfilled to the satisfaction of Departmental representatives.

Reduction of propeller diameter entails alteration in pitch setting. It is essential to have both blades of an adjustable pitch propeller set accurately to the same angle in order to obtain optimum performance and to avoid unbalanced forces with their dangerous consequences. When once set, no alteration in pitch is advisable unless adequate facilities exist for checking.

T/21/34 **25/10/34**

COCKPIT AND CABIN HEATERS — INSPECTION

Owing to the recurrence of reports of carbon monoxide gassing from faulty exhaust pipes and cabin heaters, attention is drawn to the necessity for frequent and rigid inspection of exhaust pipes to make sure that there is no leakage through to the hot air ducts.

Nearly all modern cockpit and cabin heater equipment makes provision for easy inspection by removal of the hot air collector. It is desirable, however, to bear in mind that corrosion starts on the inside of exhaust pipes and works outwards, and so it is reasonably possible to take adequate precautions by internal examination of the exhaust manifold extension pipe.

1936

T/3/36 **28/4/36**
Revised 31/3/48

MASS BALANCING OF AILERONS AND RUDDERS

In order to obviate tendencies to flutter of ailerons and rudders, these surfaces are usually mass-balanced by means of internal or external balance masses, so located as to bring the centre of gravity of the surfaces forward.

It is of great importance that no additions should be made to the surfaces referred to, whether in the course of repairs or otherwise, which will tend to nullify the existing condition of balance, since this may induce flutter and possibly, consequential failure in the air. These considerations apply equally to surfaces with and without balance masses.

Any material addition of weight aft of the hinge line of an aileron or rudder is regarded as a modification affecting the safety of the aircraft, and an aircraft so modified must not be flown until the modification has been approved by the Department of Transport.

1937

T/1/37 **31/1/37**
Revised 31/3/48

FAIREY-REED METAL PROPELLERS

1. Instances have occurred of transverse fatigue failure of the blade sheet of Fairey-Reed metal propellers, the fractures commencing at the holes for the hub bolts or the bolts securing the hub blocks, and extending towards the leading and trailing edges.

2. As the result of these failures, it is necessary that, in future, periodic detail inspection of these propellers in the vicinity of the hub blocks and identification marks be made.

3. This detail inspection is to be made after each period not exceeding 200 hours' flying, of all Fairey-Reed metal propellers. A similar inspection is also to be made, after each intermediate period not exceeding 50 hours' flying, of the propellers enumerated in list (a), and of any of those listed in list (b) which may be declared serviceable by the makers.

4. These inspections are additional to the normal routine inspections, during which the exposed parts of the blade sheets must be carefully examined for cracks, particularly in the vicinity of the blade roots and of the deeply impressed identification marks which appear on a few early propellers of this type.

5. For the purpose of detail inspection, the propellers are to be removed from the hubs, spinners from the propellers, and boss blocks from the blade sheets. The blade sheets are then to be cleaned and inspected for cracks, particularly in the vicinity of the bolt holes and in regions where any attrition or corrosion has occurred. This inspection is to be made with the aid of a magnifying glass. Inspection for cracks is facilitated by anodic treatment of the blade sheets, and if this treatment has not already been given, it is advisable for the blade sheets to be anodized as soon as this can be arranged.

6. Any propellers found to contain cracks are to be withdrawn from use, and the matter is to be reported to the Controller of Civil Aviation, Department of Transport, Ottawa.

7. If no cracks are found, any attrition or corrosion marks are to be removed from the blade sheet and boss blocks by means of coarse emery followed by fine emery, and the propellers are to be re-assembled. During the latter operation, a layer of tung oil varnish is to be inserted between the blade sheet and the boss blocks, and care is to be taken to ensure even tightening of the bolts locating the blocks. When the bolts removed are of the obsolete type in which the nuts are secured by riveting, these are to be replaced by new bolts and self-locking nuts obtainable from the Fairey Aviation Co. Ltd.

8. When spinners are being re-assembled, care is to be taken to ensure that there is sufficient clearance between the blades and the spinner body to prevent chafing.

9. After re-assembly and prior to further use, the propellers must be checked for blade angles, track, alignment and static balance, if facilities are available. The blade angles at three-quarters of the maximum radius must not differ by more than 0°10′. The difference between blades, in track and alignment measured at the tip, must not exceed 1/16 inch and ¼ inch, respectively. The error in balance must not exceed 5 inch-ounces. Should facilities for the above tests not be available, ground tests on the engine, and, if these are satisfactory, flight tests are to be made to ascertain if the propeller runs smoothly. If rough running is experienced, the propeller is to be removed from the hub, and the location bolts slacked off and then retightened. If, on further tests, rough running still persists, the propeller is to be returned to the makers or their agents.

10. The propellers which are to be subjected to detail inspection after periods not exceeding 50 hours' flying are those numbered as follows, each number being prefixed by the letters "F.R.":—

List (a)

371	1247	1469	1496	1566	2079
372	1248	1470	1498	1567	2080
491	1413	1471	1500	1568	2081
817	1414	1472	1502	1569	2082
927-H	1415	1473	1504	1570	2083
950	1425	1474	1505	1760	2085
1135	1427	1475	1506	1761	2101
1189	1429	1476	1507	1762	2103
1191	1460	1477	1508	1862-H	2105
1193	1461	1481	1509	1863-H	2274
1204	1462	1484	1510	1864-H	2278
1205	1463	1487	1512	1865-H	2321
1233	1464	1488	1513	1925-H	2323
1243	1465	1491	1515	1929	2324
1244	1466	1493	1560	2036	2326
1245	1467	1494	1561	2038	2327
1246	1468	1495	1564	2039	2686

and any of the propellers quoted in list (b) which are declared serviceable after inspection by the makers.

11. Propellers of obsolescent design, in view of their age and the possible repairs or adjustments made, are to be withdrawn from use forthwith and returned to the makers for inspection, when their serviceability will be further considered. These propellers are numbered as follows, each number being prefixed by the letters "F.R." ":—

List (b)

238	1146	1250	1485	1565	2040
247	1188	1418	1492	1571	2084
314	1208	1419	1497	1757	2086
333	1210	1424	1511	1758	2104
489	1214	1428	1514	1759	2276
500	1227	1479	1516	1866-H	2279
969	1241	1480	1562	1867-H	2325
1136	1242	1482	1563	1924	2328

12. The Certificate of Airworthiness of an aircraft affected by this Notice will be liable to suspension or cancellation unless the first detail inspection has been made, or, where applicable, the requirements of list (b) have been fulfilled within three months of the date of this Notice; exception will be made where propellers other than those quoted in lists (a) and (b) have not yet completed a total of 200 hours' flying, the allowable period being extended until this amount of flying has been completed. Certificates of Airworthiness will not be renewed and air engineers must not sign Daily Certificates of Safety for Flight in respect of such aircraft after the expiration of the afore-mentioned periods, unless the requirements of this Notice have been fulfilled.

13. If damage occurs to Fairey-Reed metal propellers, repairs must be effected at the maker's works, or other repair shop approved for this work, except when the repairs are confined to the removal of scratches and sharp nicks.

T/8/37 **29/12/37**
Revised 31/3/48

AIRCRAFT EQUIPMENT — SERVICEABILITY

The responsibility of an air engineer licensed in (a) or (b) categories when certifying as to the fitness for flight of any aircraft, includes all equipment and instruments installed in such aircraft both as to their correct functioning and general serviceability.

Instances are occurring of fire extinguishers being found empty, or nearly so. Frequent inspection is essential as the pump handle may work loose or become displaced, permitting the liquid to leak out. All extinguishers should be periodically examined and if found necessary, should be refilled.

1938

T/2/38 **18/1/38**

WELDING REPAIRS TO AIRCRAFT ENGINES

Welding repairs to aircraft engines are on no account to be done except in a shop properly equipped for the work and for the subsequent accurate checking of the dimensions and alignment of the repaired component.

Welding repairs will only be allowed at lightly stressed regions of a component where there is no danger of distorting the alignment of machined faces.

Every repair is to be treated as an individual case, and written authority for its execution is to be obtained from the Resident Inspector, A.I.D., of the District concerned. The exact nature and location of the repair, and authority for its execution are to be fully recorded in the engine log book.

T/3/38 29/1/38

AIRWORTHINESS OF AIRCRAFT INSTRUMENTS AND EQUIPMENT

The duties and responsibilities of air engineers in connection with the daily certification of aircraft include the care of all instruments and equipment which are required to be installed both by the certificate of airworthiness and the licence for scheduled air transport service.

In view of the growing importance of instruments in present day air transport, it is advisable for all air engineers to acquire further knowledge of the functioning and adjustment of instruments. This information can be obtained through the manufacturer of the aircraft or direct from the instrument maker.

T/5/38 18/2/38

TESTS FOR AIRFRAME WELDERS

1. Information Circular T/1/38, "Tests for Airframe Welders", and the appendix to the publication "Information Circulars to Air Engineers and Aircraft Owners, January 1, 1928 to June 30, 1937", entitled "Welders", are hereby cancelled.

2. The service offered in the past has achieved its object, and as the Department of Transport does not issue licences to aircraft welders, it is no longer prepared to test welding specimens at the request of individuals.

3. It is still recognized that an aircraft welder requires constant practice to maintain the requisite standard of his work, but it is held to be the responsibility of the employer to ensure that the work of his employees conforms to the necessary standard. Employers are, therefore, urged to require, periodically, test specimens from the welders in their employ. These specimens can be sectioned and broken in the workshop for examination, which will reveal most of the defects attributable to workmanship. Only under special circumstances should it be necessary to submit specimens to a testing laboratory for report.

4. Private individuals who desire to check their skill at welding are advised to section and break their own specimens until a stage of proficiency is reached which would justify the cost of submitting samples to a testing laboratory for test and report. Such testing laboratories can usually be found at schools of engineering.

5. The assistance of the nearest Resident Inspector, A.I.D., from whom copies of the standard drawing for Weld Test specimens can be obtained, may be requested for advice and criticism of specimens, provided that no cost to the Department is involved.

6. The welding of aircraft structures must be certified as airworthy by a licensed "B" engineer, and the Department reserves the right to test the work of any individual engaged in welding aircraft structures by demanding the submission of specimens in accordance with the standard drawing.

T/8/38 9/3/38

RADIO INSTALLATIONS IN AIRCRAFT

Revised 31/3/48

(Airworthiness Aspect Excluding Functional Efficacy)

1. All aircraft manufacturers and operators are reminded that the installation of radio in an approved type aircraft constitutes a modification to an approved design which affects the safety and possibly the performance of the aircraft. The introduction of an unauthorized modification automatically invalidates the Certificate of Airworthiness.

2. Unless complete information is provided, it is impossible for the technical officers of the Department to judge whether or not either the safety or the performance of the aircraft has been affected adversely by the installation of radio. For instance, an aerial attachment on a control surface may affect the mass balance of that surface and introduce flutter hazards. Again, a fixed loop attached to the fuselage immediately forward of the vertical tail surfaces may interfere adversely with the airflow, and must

be designed to possess adequate factors of safety in the attachment in order to obviate the possibility of failure and consequent fouling of the tail surfaces during flight. Fire hazards in the wiring system must be reduced to a minimum, and the use of radio apparatus and electrical fittings of doubtful quality might endanger the safety of the aircraft. The weight distribution of the various parts employed in the installation may affect adversely the balance of the aircraft, and will certainly affect the empty and tare weight.

3. For the above reasons, each type installation must receive approval regarding the strength, weight distribution, fire risk and general airworthiness of the aircraft, and duplicate copies of drawings completely illustrating these points are required to be submitted to the Department for examination, accompanied by all calculations necessary to ensure satisfactory strength in attachments and in the main structure affected by concentrated loads in the system. These drawings, when approved, will form the basis for inspection and the signing and endorsing of any relevant release note or Certificate of Airworthiness.

4. Major modifications to an approved type radio installation must be regarded in the same light, that is, as a modification to an approved type design which requires complete formal approval.

5. All aircraft manufacturers and operators are reminded of the importance of radio reception free from interference. Interference to reception in aircraft can be caused either by the normal operation of electrical equipment or by faults in the electrical wiring. Faults in electrical wiring, in addition to preventing satisfactory reception, can produce serious fire hazards, and the detection of such faults by radio methods is highly efficient. The Radio Division of the Department of Transport on November 15th, 1944, issued a publication entitled "Investigation, Measurement and Suppression of Radio Interference in Aircraft" (Frequency Range 150 kcs. to 30 mcs.) by H. O. Merriman. Copies of this publication are available on request, free of charge.

6. During 1943 and 1944, detailed investigations were conducted on a number of types of aircraft, and specified methods of suppressing interference are also available on request. The Radio Division is prepared to give advice or make tests of interference at frequencies up to 400 mcs.

T/14/38 **28/4/38**

STRUCTURAL FAILURES — AIRCRAFT

Revised 31/3/48

1. When a structural failure occurs either in an engine or an airframe, the owner or pilot is required by Part VIII, Para. 20 (2) of *Air Regulations* to give particulars of the damage. A structural failure is always a potential cause of an accident and, consequently, the Department of Transport desires, in the interest of safety, to receive an immediate and full report on every structural failure so that the cause may be ascertained, and, if possible, eliminated in order to avoid a repetition of similar failures. The defective parts constitute a portion of the most important evidence from which the cause of the failure may be determined and, therefore, they must be held for inspection by an official of the Department.

2. On no account may defective parts, which form a portion of the evidence respecting a structural failure, be sent out of Canada without the written permission of the Department. This permission may be solicited from the nearest Inspector of Civil Aviation who will, at his discretion, refer the matter to Department Headquarters.

3. Defective parts must be preserved as nearly as possible in the state in which they were when the failure occurred. If the failure is of an important nature, for example, a broken propeller crankshaft, or a structural fitting, it is very desirable to make a photographic record at the first opportunity in order to preclude the chances of loss of evidence through any cause whatsœver.

4. A structural failure may be defined as the failure of any part of an aircraft by reason of which loss of sustentation of control or of continuous propulsive effort might result. Damage by collision with external objects is not included.

LICENCE TO CERTIFY THE AIRWORTHINESS OF PROPELLERS AFTER OVERHAUL OR REPAIRS. (EXCEPTING FIXED PITCH WOODEN PROPELLERS.)

1. Owing to the increasing complexity of the modern propeller, marked not only by the greater complication of the mechanism but also by the selected qualities of the materials employed, the overhaul and repair of propellers requires the supervision of persons having special knowledge, and consequently, it has been decided that no person shall be empowered to certify the airworthiness of a propeller after major overhaul or repair without a licence from the Department of Transport.

2. The licence may take the form of an endorsement of an existing Air Engineer Certificate in Category B or D or, in the case of persons not holding such a certificate in good standing, a letter of authority from Headquarters of the Civil Aviation Division.

3. The operations, all or any of which constitute a major overhaul or repair, are:—

(i) Assembly of new parts requiring fitting or machining operations.
(ii) Rectification of distorted blades within cold straightening limits.
(iii) Twisting blades of one piece metal propeller.
(iv) Grinding, polishing and trimming blades.
(v) Inspection of blades by the aid of the etching or anodic process.

4. To be eligible for a licence to certify the airworthiness of propellers after major overhaul or repair, a person must show proof of knowledge and experience described as follows:—

(i) Knowledge of *Air Regulations 1938*, Parts I, II, IV, VII and VIII.
(ii) Knowledge of the meanings of engineering terms and phrases such as stress, strain, work, power, thrust, horse-power, centrifugal force, etc.
(iii) Elementary knowledge of the aerodynamic theory of propellers.
(iv) Knowledge of the materials used in propeller construction, including chemical composition, methods of manipulation and heat treatment during manufacture, properties, identification, examination and testing.
(v) Specific intimate knowledge of the particular model or models of propellers for which application for licence is made, including:—
    General principles of construction and operation.
    Inspection of finished parts for dimensions, weight balance, etc.
    Correcting parts for weight and balance.
    Dismantling and re-erecting.
    Clearances and tolerances.
    Discovery and rectification of defects.
    Assembly to engine and check testing.
    Adjustments for performance.
(vi) General experience in machine shop practice of a length at least equal to that required for a B or D Certificate.
(vii) Special experience equivalent to at least one month's intensive training at the plant of a manufacturer of propellers or at an approved propeller repair shop.

5. (i) An applicant's qualifications will ordinarily be established by examination, but, in order to meet the immediate requirements of the industry, the Controller of Civil Aviation may in special cases waive examination on the production of satisfactory letters of reference which must include a letter of approval from the manufacturer of the propeller or his principal agent in Canada.

(ii) The examination will comprise a written or oral check of the applicant's knowledge of Air Regulations followed by a written technical examination in two parts. Part I will consist of general questions dealing with the subjects specified in sub-paras. (ii), (iii), and iv). Part II will consist of specific questions on the subjects specified in sub-para. (v) of Para. 4 of this circular.

(iii) Holders of Air Engineer B or D Certificates in good standing, whose application for examination has been approved, will only be required to undergo Part II of the technical examination.

6. Application is to be made to the nearest District Inspector, Air Regulations, Civil Aviation, on the form prescribed for Application for an Air Engineer Certificate and is to be accompanied by letters of reference or other satisfactory documentary proof of the applicant's experience.

7. This circular should be read in conjunction with Information Circular T/20/38 dealing with Approved Propeller Repair Shops, which becomes effective 90 days after date of promulgation.

T/20/38 **8/9/38**

PROPELLER REPAIR SHOPS

Revised 31/3/48

(Fixed Pitch Wooden Propellers are not Affected by the Following Notice)

1. A propeller is considered to be a major component of an aircraft and, as such, requires the attention of qualified specialists. Consequently, the major overhaul of a propeller for an aircraft having a Certificate of Airworthiness may only be done at a propeller repair shop which has been approved by the Department of Transport in respect of the model of propeller in question.

2. The operations, all or any of which constitute a major overhaul or repair, are:—

(i) Assembly of new parts requiring fitting or machining operations.

(ii) Rectification of distorted blades within cold straightening limits.

(iii) Twisting blades of one-piece metal propellers.

(iv) Grinding, polishing and trimming blades.

(v) Inspection of the blades by the aid of the etching or anodic process.

3. The requirements for an approved Propeller Repair Shop are:—

(i) Qualified personnel, including at least one person licensed by the Department, to certify the airworthiness of a propeller after overhaul and repair. The rules governing the issue of such a licence are published in Information Circular T/19/38.

(ii) Equipment:

(1) Balancing stand with knife edge and arbor with suitable mandrels.

(2) Propeller surface table and mandrels.

(3) Supply of crocus cloth.

(4) Riffle files.

(5) Drilling machine with full set of drills.

(6) A supply of lead wool, and tools suitable for removing and replacing lead wool.

(7) A supply of caustic soda and nitric acid.

(8) Precision calipers for measuring thickness of blades.

(9) Bevel protractor for measuring angle of bend in propeller blades.

(10) Suitable tanks in which to etch propeller blades.

(11) Suitable press for straightening propeller blades cold.

(12) Suitable twisting bars.

(13) Magnifying glasses for inspecting for cracks, 4-6 power.

(14) Portable power grinder and buffer with grinding wheel.

(15) Means of placing manufacturer's identification numbers and date of repair on blades so that disassembly is unnecessary at the time of inspection.

(16) Large accurate protractor suitable for measuring pitch angles of propeller blades together with parallel blocks for raising same as required to cover the range of blades to be overhauled.

(16-A) A toolmaker's surface gauge of proper size for measuring face and edge alignment together with toolmaker's combination square, graduated in 50ths of an inch.

(17) Necessary gauges and alignment plugs to suit the propeller hubs and blades being overhauled.

(18) Necessary spline adapters for range of propellers to be overhauled.

(19) Cadmium plating equipment installed or readily available.

(20) Magnetic or similar inspection equipment installed or readily available for inspection of hubs, spiders, etc.

(iii) Possession of complete drawings and technical instructions from the manufacturers of the propellers.

(iv) Suitable quarters adequately ventilated, heated and lighted, including a store properly arranged to ensure the segregation of parts and materials.

(v) An organized system of keeping records of all work.

4. Approved propeller repair stations are not empowered to do work involving annealing or other heat treatment without specific extra authority, which may be obtained by application to the nearest Department of Transport Resident Inspector, A.I.D., and on the production of proof that suitable equipment, technical instructions and trained staff are available.

5. An applicant for the Department's approval for a Propeller Repair Shop is requested to adopt the following procedure:—

(i) Conclude negotiations with the manufacturer of the model of propeller for which approval is desired.

(ii) Set up the plant and equipment specified in Paragraph 3 and any additional equipment specially demanded by the propeller manufacturer.

(iii) Engage as Chief Inspector a person licensed by the Department to certify the airworthiness after overhaul of the particular type or types of propeller involved in the application for approval.

(iv) Apply to the nearest District Office, Civil Aviation, for inspection and report by the Resident Inspector, A.I.D., who will forward the application with his report to the Headquarters of the Department.

6. After 90 days from the date of this notice an air engineer must not certify as airworthy an aircraft fitted with a propeller which has undergone overhaul or repairs as described in Paragraph 2, unless the propeller has been certified to be airworthy by the Inspector of an approved Propeller Repair Shop.

NOTE:—For information as to approved propeller repair depots see Information Circular T/22/38 and Appendix thereto.

T/21/38 **8/9/38**

Revised 31/3/48

LIGHT ALLOY PROPELLERS — SERVICE RECORD

1. Because of the limit of life of light alloy propeller blades, beyond which the likelihood of failure by fatigue becomes ever more present, aircraft owners or operators are required, as from October 15, 1938, to keep separate records of the service history of metal propellers. These records are to contain such information as the source and date of supply, inspections, repairs, tests, overhauls, dismantling, etching, balancing, as well as the actual length of service in flying hours.

2. The following rulings will apply to propellers for which records have not in the past been kept:

(i) A metal propeller in service in Canada will be debited with as many hours service as the aircraft on which it is fitted, unless the owner can prove otherwise.

(ii) A propeller transferred from one aircraft to another will be debited with as many hours as the sum of the hours for all aircraft on which the propeller has been installed, unless the owner can prove otherwise.

(iii) The length of service as determined by the foregoing rulings or by the owner's records will constitute the initial entry in the log book when the keeping of records becomes obligatory.

3. The airworthiness of a propeller transferred from one aircraft to another must be established by the previous life record as well as inspection by a licensed air engineer at the time of the approval.

4. Used metal propeller blades and hubs obtained from the U.S.A. will not be considered as airworthy, unless the life record can be subtantiated.

5. United States regulations governing the export of aircraft and equipment recognize complete propellers as class one units, requiring a Certificate of Airworthiness for Export. Propeller components are class two units, the condition of which may be certified by C. A. A. Inspection Tag 186. Before Tag 186 can be attached, however, the United States authorities require a statement in affidavit form of the total life of a used propeller and the service time since last overhaul. The Canadian purchasers are advised to insist upon a copy of this affidavit from the source of supply.

6. When a propeller is installed on an aircraft, the log book of the propeller is to be kept in company with the log book of the aircraft, and it is to be produced on the request of any Civil Aviation Inspector.

7. Attention is drawn to Information Circulars T/1/37.

8. Propeller Log Books may be obtained from the Department of Public Printing and Stationery, Distribution Branch, Ottawa, referred to in Information Circular 0/62/47.

T/22/38

Original — Oct. 11, 1938
1st revision — Oct. 15, 1940
2nd revision— Aug. 1, 1944
3rd revision — July 15, 1945
4th revision — March 31, 1948

AIRCRAFT INSPECTION AT FACTORIES, REPAIR SHOPS AND SUPPLY HOUSES

Introduction:

1. A Certificate of Airworthiness is issued by the Department of Transport only after the competent officials of the Department are satisfied that an aircraft conforms to approved design in all respects, including methods of construction, materials, equipment, weight and balance.

2. The only way to make sure that a product is airworthy, or eligible for embodiment in an airworthy aircraft, is to exercise a system of supervision and inspection at every operation from raw material to finished product. This involves a system of certification whenever an article passes from the hands of one controlling unit to those of another. For example, a steel manufacturer will certify his steel to, let us say, a tube mill which will in turn certify the finished tubing delivered to a distributor. The distributor does not usually hand on the entire shipment and, therefore, cannot use the certificate from the tube mill but must issue his own certificate in respect of each parcel he handles. The aircraft manufacturer will have the distributor's certificate as justification for using the tubing in the fabrication of any aircraft part.

Organization:

3. The departmental staff charged with the duty of aircraft inspection at factories, repair shops and supply houses is very small in number and is widely scattered, and consequently the machinery for ensuring the initial airworthiness of products must include responsible persons employed in the aircraft and allied industries. It is, therefore, required that companies and persons engaged in the business of manufacture, repair or supply of aircraft, aircraft accessories, aero engines and accessories, or materials for use in aircraft should nominate qualified individuals to act as inspectors to examine and certify the eligibility of their products for use in airworthy aircraft. Each certificate is dependent upon a certificate from the immediately preceding unit in the chain and its validity may ordinarily be recognized on that basis without going any further back.

Qualifications of Approved Inspectors:

4. In order that an individual may be recognized by the Department as competent to certify at the factory or repair shop the airworthiness of aircraft, aero engines, propellers, or components of any of these he must, as a minimum qualification, be the holder of an Air Engineer Certificate or licence in the appropriate category, and his authority to certify must be limited to types endorsed on his certificate, viz.,

Aircraft and components thereof	— Air Engineer Certificate "B"
Aero engines and components (not including proprietary accessories)	— Air Engineer Certificate "D"
Propellers (of metal or composite construction)	— Department's letter of authority or endorsment on "B" or "D" certificates.

The possession of any of the above certificates or licences will not necessarily mean that the Department will approve the nomination of an individual to act as an Inspector in respect of the articles mentioned in this paragraph.

5. For recognition by the Department for competency to certify articles and materials other than those mentioned in paragraph 4, it is not necessary for an individual to be the holder of an Air Engineer Certificate; but his employers must be prepared to show proof of his fitness to undertake the duties required of him.

Nominations:

6. Nominations of individuals for recognition by the Department as responsible inspectors are to be submitted to the Resident Inspector, A.I.D., at the nearest District Office of Civil Aviation. The nomination should state the scope of the responsibility desired and should be supported by a statement of the qualifications of the individual concerned.

7. The Department's recognition of an individual as a responsible inspector will lapse when the individual leaves the employ of the nominator.

8. It is desirable to limit the number of persons empowered to certify as to airworthiness to the smallest quantity necessary to meet the demands of the industry. Consequently, one individual only should be nominated as Chief Inspector in respect of a single manufacturing unit or enterprise; but a second individual may be nominated to act as deputy when the Chief Inspector is unavoidably absent for periods exceeding casual absences of a few hours. Any number of persons may be employed to assist the Chief Inspector; but this is a matter which concerns the management of the enterprise, and the Department is only concerned to ensure that the number of the inspection staff is adequate to execute the amount of work. The Department will only recognize the responsibility of the Chief Inspector.

9. In regard to companies supplying fuel and lubricants to the industry, the position is to some extent different from that of concerns supplying other aircraft products. These companies have large organizations from coast to coast comprising refineries, bulk storage depots, retail depots and caches, and, therefore, it is not possible to record in Appendix II the locations and names of approved inspectors for each. The addresses of refineries or the main source of supply, together with the names of the approved inspectors at those points only, will be recorded, and therefore, the companies concerned are advised to set up within their own organization such inspection procedure as will ensure the proper control of their products from the source of supply to the consumer.

Inspection Release Certificates:

10. The Department has prepared sample forms for Inspection Release Certificates, copies of which may be obtained on application to the Resident Inspector, A.I.D., at the nearest District Office, Civil Aviation. The forms are as follows:

Title	*Identification*
Aeroplane Inspection Release Certificate (for Production Aeroplanes having Canadian Type Approval)	A.I.-1
Aeroplane Inspection Release Certificate (for Aeroplanes Assembled with Imported Components)	A.I.-2
Canadian Aeroplane Components (including propellers)	A.I-3
Imported Aeroplane Components	A.I.-4 (Issue 2)
Aero-Engine Inspection Release Certificate (for "subsequent" and "overhauled" CanadianAero-Engines)	A.I.-5
Aero-Engine Inspection Release Certificate (Aero-Engines, Propellers, relevant accessories and any parts thereof assembled or overhauled in Canada)	A.I.-6 (Issue 3)
Imported unused Aero-Engines, Propellers, relevant accessories and any parts thereof	A.I.-7 (Issue 2)
Aircraft Materials	A.I.-8
Aircraft Instruments and Proprietary Accessories	A.I.-9
Fuel and Lubricants	A.I.-10
Surplus Military Aircraft	A.I.-11

The wording of these forms has been designed to emphasize as concisely as possible the extent and the limitations of the Inspector's responsibility when he signs his name to a certificate.

11. The Department has no intention of stocking printed forms for Inspection Release Certificates. Forms A.I.-1, A.I.-2 and A.I.-11 are rather long and complicated and a great number is not likely to be required, so the Department is willing to supply mimeographed copies on demand. Forms A.I.-3 to A.I.-10 are to be supplied by the originators. They may be printed, typed or mimeographed, or a rubber stamp may be employed.

12. It is undesirable to use a single document as a combined Invoice and Inspection Release Certificate, unless a sufficient number of copies are made and forwarded to permit the recipient's inspector to have a copy for his own records.

13. Release Certificates for complete major units, namely aircraft and aero-engines, require the endorsement of the Resident Inspector, A.I.D. Other units and materials for use on airworthy aircraft of Canadian Registration will be accepted on the basis of Release Certificates signed by an Approved Inspector.

14. For export purposes all Release Certificates, except those for materials (Form A.I.-8), must be endorsed by the Resident Inspector, A.I.D.

15. The number of copies and distribution of Inspection Release Certificates is to be as shown on the appended table.

16. Importers of aircraft components, accessories or materials manufactured outside Canada must keep in their own records the documentary evidence supporting the airworthiness of the imported articles and will issue Canadian Inspection Release Certificates in their stead.

List of Approved Inspectors:

17. An appendix to this circular is published containing a list of manufacturers, repair shops and other enterprises, together with the names of persons who have been nominated and approved as inspectors. It is requested that employers notify the Department promptly of any change or addition which it is desired to make to the list. Copies of the appendix may be obtained on application to Information & Publications Section, Civil Aviation.

18. Every air engineer will be held responsible that no components or materials will be embodied in airworthy registered aircraft without either having been satisfactorily cleared by Inspection Release Certificate, from a Canadian source, or other satisfactory evidence of airworthiness which may be in the form of:

(a) A Certificate of Airworthiness issued by the licensing authority of the country of manufacture or the official notification of the despatch of such certificate to the Department of Transport, Ottawa.

(b) Release note from a British "Approved Firm".

(c) United States Civil Aeronautics Administration (C.A.A.) Inspection Tag (Form 186).

(d) Certificate on the invoice in respect of Class III materials imported from the United States. This class includes small standard parts, cowling, instruments, landing lights, ventilation equipment, tires, bolts, nuts, rivets, cotter pins, standard ball or roller bearings, and some materials.

Classification of Aircraft Units:

19. With reference to para. 18 sub-paras. (c) and (d), it is thought that the United States definitions of Class I, Class II and Class III aircraft units will give a clearer understanding of the export procedure adopted in that country. These definitions are to be found in U.S. Inspection Handbook, Chapter XII (Inspection for Export), and for the information of all concerned are quoted below:

(a) *Class I Units:*

These are defined as any complete aircraft or aircraft units having type approvals in themselves, or major assemblies of aircraft structural parts. Items in this class are complete aircraft, aircraft engines, propellers, wheels, floats, skis, position lights, landing flares and safety belts, or a complete wing, tail surface, aileron or fuselage.

(b) *Class II Units:*

Any assemblies or parts, other than those specified in I (a) above, which directly influence the airworthiness of an aircraft, except small standard parts. Items in this class are any structural part or assembly of an aircraft and any functioning or structural part of either an engine or propeller, except bolts, nuts, rivets, cotter pins and standard ball or roller bearings.

(c) *Class III Units:*

These are defined as parts which have influence on airworthiness, parts which are not covered by specific regulations and small standard parts. Items in this class include cowling, instruments, landing lights, tires, sound-proofing material, ventilation equipment, bolts, nuts, rivets, cotter pins and standard ball or roller bearings.

Unfinished castings are also considered to be Class III items.

DOCUMENTARY EVIDENCE OF AIRWORTHINESS REQUIRED FOR EACH CLASS:

(Ref. U.S. Inspection Handbook, Chapter XII)

20. (a) Units for export in Class I must be covered by documentary evidence of airworthiness issued by the U.S. Civil Aeronautics Administration. This evidence is in the form of either a Certificate of Airworthiness for Export or a certified Inspection Tag (Form 186), depending on the type of unit.

(b) Units for export in Class II either are covered by the manufacturer's invoice identifying the units or are certified by the Civil Aeronautics Administration as airworthy, the alternative procedure adopted and the documents issued being explained as follows:

(i) Aircraft units withdrawn from the stores of a manufacturer, the holder of a production certificate for the pertinent model (or his designated agent), may be covered by the manufacturer's invoice identifying the units. The invoice should contain a statement certifying either the applicable type specification number or the production certificate number under which the units have been manufactured, and that they are new and not rejects. This invoice, therefore, will serve as evidence that the units are airworthy and were manufactured in accordance with approved specifications.

(ii) Aircraft units not withdrawn from the stores of a manufacturer, the holder of a production certificate for the pertinent model (or his designated agent), are certified by the Civil Aeronautics Administration as airworthy, the evidence being in the form of the C.A.A. certified Inspection Tag (Form 186).

(c) Units for export in Class III may be shipped without reference to the Civil Aeronautics Administration. In these cases, the manufacturer's invoices should be so written that they will serve as evidence to the authorities of the importing country that the parts were manufactured in accordance with the approved specifications of a particular aircraft or component. The applicable specification should be named and the invoices should also contain a certification that the parts are new and in conformity with accepted practices.

21. Air engineers are warned that the existence of an Inspection Release Certificate does not necessarily absolve them from exercising the wise precaution of a personal inspection.

DEPARTMENT OF TRANSPORT

Civil Aviation Division

APPENDIX I

to

INFORMATION CIRCULAR NO. T/22/38

(Cancelling previous issue of the Appendix)

DISTRIBUTION OF COPIES OF INSPECTION RELEASE CERTIFICATES

	Complete Aeroplanes				Aeroplane Components				Complete Engines				Engine Parts		Materials		Instruments, etc.		Fuel and Oil		Surplus Military Aircraft	
Inspection Release Certificate	A.I.-1		A.I.-2		A.I.-3		A.I.-4		A.I.-5		A.I.-6		A.I.-7		A.I.-8		A.I.-9		A.-I.-10		A.I.-11	
	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex	Dom	Ex
Originator's Records	1	1	1	NE	1	1	1	NE	1	1	1	NE	1	1	1	1	1	1	1	1	1	
Civil Aviation District Office	1	1	1	NE		1		NE	1	1	1	NE		1				1			1	
Transport H.Q.	1	2	1	NE		2		NE		2		NE		2				2			1	
Purchaser	OP	OP	OP	NE	1	OP	1	NE	1	OP	1	NE	1	OP	1	1	1	1	1	1		
Purchaser's Approved Chief Inspector*					1		1		1		1		1		1		1					

* The eligibility of an article for use in airworthy aircraft must be proven by the Chief Inspector to the satisfaction of the Air Engineer who is responsible for the ultimate installation. Therefore, when a purchaser maintains a central depot from which redistribution is made to an outlying station or base, the depot must despatch with the article a copy of the original release note signed by a responsible inspector.

NOTE:—Dom – Domestic Use Ex – Export OP – Optional NE – Not eligible.

T/28/38 16/12/38

FIRE EXTINGUISHERS — CARBON DIOXIDE

The amount of liquid in carbon dioxide fire extinguishers must be carefully measured in accordance with the instructions of the manufacturer in order to avoid the danger of excessive gas pressure when the extinguisher is exposed to a high temperature, such as occurs when an aircraft is left out in the sun in the summer time.

It is advisable to arrange for refilling by the authorized agents of the fire extinguisher manufacturer.

1939

T/1/39 11/1/39
Revised 31/3/48

AIRCRAFT FLYING AND POWER PLANE CONTROLS — INSPECTION

Inspection of Flying and Power Plant Controls must be carried out separately by two competent Inspectors, (a) on a new aircraft, (b) on an overhauled aircraft, and (c) on an aircraft after repairs and replacements or adjustments have been made which affect the controls.

The approved Engineers responsible must make an entry in the Engine and/or Aircraft Log Books, on completion of each inspection. The final inspection is to be made prior to flight.

T/3/39 8/2/39
Revised 31/3/48

DAMAGED PROPELLER BLADES

1. It has been brought to the attention of the Department that damaged propeller blades have been rough-straightened before shipping to a repair station.

2. The permissible limits of cold straightening are definite and it will be appreciated that the practice referred to in para. 1 is unsatisfactory, in that a blade which has already been bent beyond permissible limits may be, unknowingly and in good faith, rectified and certified by a repair station.

3. Operators are, therefore, instructed that, when a propeller blade is bent, it must be sent to the manufacturer or approved repair station for straightening in an unaltered condition or, if for any special reason this is not possible, an accurate sketch showing the original damaged condition must be forwarded with the blade to the repair station.

T/5/39 *Original Issued 31/3/39*
1st Revision 15/3/48

MODIFICATIONS AND REPAIRS TO REGISTERED AIRCRAFT AIR REGULATIONS (1938)

1. The attention of all concerned is directed to *Air Regulations (1938), Part VIII, Para. 20 (2)*, which require either the owner or pilot of any aircraft registered in Canada to notify the Department forthwith of any repairs other than ordinary running repairs or replacements. Such notification should be made to the District Inspector, Air Regulations, Civil Aviation, in whose district the work involved is being done.

Certification by Air Engineers

2. An air engineer must not certify as airworthy any repairs or modifications which affect either the structural strength or performance or safety qualities of a registered aircraft, unless the work involved complies with one of the following:—

(a) A method described in a manufacturer's repair manual.

(b) A method described in an authoritative manual, such as the *U.S. Civil Aeronautics Administration Manual No. 18.*

(c) Instructions contained in a manufacturer's Service Bulletin.

(d) Drawings issued and approved by a qualified aeronautical engineer normally employed by a bona fide aircraft manufacture, repair or overhaul organization. Copies of all such drawings, calculations, tests and reports must be subsequently submitted to the Department for confirmation, together with a certificate signed by the aeronautical engineer. This certificate is to guarantee the accuracy of any calculations and/or results of tests submitted with the drawings, and certify compliance with specified airworthiness standards.

(e) Drawings approved by the Department.

3. Work done complying with any one of sub-paras. (a), (b) or (c) above may, after completion, be certified by a "B" category air engineer without further reference to the Department other than the official notification mentioned in para. 1. If, however, there is any doubt whether the work is adequately and accurately described in the manuals or bulletins, the matter is to be referred to the nearest District Inspector, Air Regulations, Civil Aviation, for a decision.

4. "A qualified aeronautical engineer" is one, who by reason of his training and experience in aeronautics, is capable of professional responsibility for the drawings, calculations, test and engineering reports necessary to substantiate the airworthiness of the repair or modification and who has been approved by the Department. Normally such approval will only be recognized during the period of the engineer's employment with the particular manufacturer. The Department may also recognize the professional standing of an aeronautical engineer registered as such in the province in which he is practising and may grant approval as a qualified Aeronautical Engineer. Departmental approval, however, does not imply automatic qualification of membership in any recognized body of professional engineers. It is only the recognition of certain qualities which would enable the engineer to act on behalf of the Department for the design and approval of repair schemes which subsequently must be submitted to the Department as outlined above.

5. Drawings dealing with repairs or modifications to individual registered aircraft and submitted for approval by the Department should be forwarded to the nearest District Inspector, Air Regulations, Civil Aviation.

Log Book Entries

6. Full particulars of all work done, reference to either any repair manual or Service Bulletin used, or the drawing numbers of any approved drawings forming the basis for airworthiness certification, must be given in the aircraft log book by the responsible air engineer before completing the certification called for in Information Circular T/3/48.

Repairs to Damaged Spars

7. In the case of a repair to a damaged spar, unless made either under the supervision and instructions of a fully qualified aeronautical engineer, or in accordance with a manufacturer's Service Bulletin, complete information and drawings must be submitted to the Department for final approval even if the method adopted follows that recommended in an accepted repair manual, and no airworthiness certification should be made by the responsible air engineer until final approval of the drawings has been given.

Incorporation of Modifications Similar to Ones Previously Approved

8. It sometimes happens that modifications similar to ones already designed and incorporated by another organization are to be installed. In such cases there is no

need to prepare new drawings or calculations, or submit tests provided the original designer will provide a copy of his drawings covering the modification or change. In such instances when drawings are provided, a certificate should be forwarded either on the invoice or separately, stating that such drawings are copies of the originals which have been previously approved by the Department and which are on file with the Department.

T/8/39 **14/3/39**

SERVICE BULLETINS ISSUED BY AIRCRAFT AND AERO ENGINE MANUFACTURERS

1. Manufacturers of aircraft and aero engines often issue instructions regarding necessary modifications or changes to their products, these instructions being in the form of Service Bulletins which are made available to all concerned. It may be presumed, on receipt of any Service Bulletins, that the modifications or changes in question have already received concurrence from the authorities responsible for the approval of the type affected by the modifications or changes.

2. The Department cannot undertake to republish manufacturers' Service Bulletins, and in order to ensure, as far as possible, that such instructions affecting Canadian owners of equipment are observed, all overhaul and repair shops and owners are advised to file their names with manufacturers of equipment with which they are concerned for receipt of Service Bulletins.

3. In addition, when changes of ownership occur, the new owners are strongly recommended to take similar action.

T/14/39 **22/7/39**

AERO ENGINE SERIAL NUMBERS

1. The serial number of an engine is not to be changed even though that part of the crankcase which, as a matter of convenience, bears the number plate is replaced.

2. The serial number of an aero engine is the most important clue to the date of manufacture and the details of the materials and construction of the components embodied in the engine. Service Bulletins and similar documents introducing changes usually contain a reference to serial numbers.

3. The old number plate is to be removed from the old rejected crankcase part and affixed to the new part, and the letter **A** is to be stamped after the serial number to indicate that such a change has been made. Details of the new crankcase part with its own serial number, if any, are to be entered in the engine log book. Should it ever be necessary to repeat the change, the letter **A** is to be struck out and the letter **B** stamped on, and so on.

1940

T/4/40 **20/8/40**

AERO ENGINES — RUNNING IN AND TESTING AFTER OVERHAUL

1. It has been brought to the attention of the Department that there exists a great divergence of opinion and practice in the matter of "running in" and testing aero engines after complete overhaul, and so it is deemed to be desirable to lay down a few basic principles and a minimum standard which must be observed in order to ensure airworthiness.

2. The running in and test of an aero engine following assembly is an integral part of the overhaul procedure, therefore the operation must be done under the supervision of an air engineer having a certificate in Category "D", and the inspection release certificate is not to be signed until the full procedure has been completed.

3. There are two distinct objects to be achieved; first, the settling of the engine parts into their proper working order, which is effected by a careful and thorough tuning in at light load and low speed; secondly, to determine whether the engine performance will meet the minimum rating for its type and model and is of a satisfactory quality.

The separate operations to be performed on the test stand may be distinguished as

Running In
Endurance Test
Auxiliary Test

Test Equipment

4. Running in and test should be conducted on a properly made test stand sheltered from the weather and affording proper facilities for servicing the engine, making the required observations and ensuring the safety of personnel. The construction of the stand should not be too rigid but should allow for a degree of flexibility, approximating that in an actual aeroplane.

The following measurements must be made and recorded on the test log of all aero engines:—

Barometric pressure
Atmospheric temperature
Running time
Engine speed
Oil inlet temperature (except wet sump engines)
Oil pressure
Fuel consumption
Oil consumption

5. In addition, the following observations are desirable on most aero engines and essential on those of the higher B.V.E.P. ratings:—

Oil outlet temperature
Carburettor air temperature
Cylinder head temperature
Manifold pressure
Fuel pressure

6. Preferably, the tests should be done with a calibrated test fan or club adjusted to absorb the rated power at the rated manifold pressure while at the same time creating a slip-stream sufficient to ensure adequate cooling of the engine. The use of the propeller off the aeroplane may be permitted when the number of engines of a given model is small, but it must be observed that the slip-stream created by a "flight propeller" is not usually sufficient to cool an engine operating without forward motion at a high proportion of its rated power. The cylinder and oil temperatures must be carefully watched, and the engine must not be operated at full throttle for more than a few minutes at a time. A flight propeller will not permit the engine to reach its rated speed without forward motion, and some engine makers recommend that the final part of the endurance test should be done in flight, circling the landing field in case of trouble. This may be permitted provided that the aeroplane is flown light so that the take-off may be made without employing full take-off power, which, if done prematurely, may cause serious harm to the engine.

Running In

7. The time required for running in is to be in accordance with the published instructions of the engine manufacturer but must, under no circumstances, be less than one hour. All time occupied in working at a speed and power below that of cruising range will be counted as running in time and will not be counted as test time.

Endurance Tests

8. The endurance test time to be counted will include all continuous running at cruising power and above and is to be in accordance with manufacturers' instructions, but, on no account, must it be less than two hours unless the technique of disassembly and internal examination followed by final test be adopted.

During the endurance test, a rich mixture may be used but sufficient running must be done at the weakest mixture for maximum power at a given engine speed to prove satisfactory performance under this condition.

The endurance test is to be concluded with a run at full throttle or rated speed for a period of not less than three minutes.

Auxiliary Tests

9. At the conclusion of the endurance test and while the engine is still warm, the following auxiliary tests are to be made:—

(a) *Slow running test.*—To prove that the engine will run reasonably well at a speed about 70 per cent below rated speed.

(b) *Vibration and Acceleration test.*—To prove that the engine will run smoothly at all speeds and will open up from the slowest running speed to the rated speed within five seconds without excessive popping or periods of irregular running.

(c) *Single ignition test.*—To prove that when the engine is running at full throttle or rated speed, the drop in speed when one ignition system is switched off will not exceed five per cent.

T/5/40 **13/9/40**
Revised 31/3/48

HAMILTON STANDARD PROPELLERS

1. Light alloy propeller blades have an indeterminate limit of life beyond which the likelihood of failure by fatigue becomes ever more present. Failure usually starts with a small crack just out of sight inside the hub on the trailing portion of the blade root. The crack increases progressively until the section of the blade root is so reduced that it can no longer resist the forces imposed and the blade flies off suddenly.

2. A thorough inspection requires that a propeller be completely dismantled, and even then the detection of an incipient fatigue crack is a very difficult matter. There is no certain knowledge of the rate of progress of the failure from the time a crack is first formed to the time the propeller is completely destroyed because no one would deliberately keep a propeller blade in service once a crack had been detected. There is, however, reason to believe that the rate of progress may be extremely rapid and the whole process will almost always be completed well within the normal period between routine inspections.

3. In view of the uncertainty attendant upon inspection, it becomes necessary to resort to some other method for judging the probable airworthiness of a propeller. To this end, the Hamilton Standard Company has, as a result of statistical studies, been able to make recommendations as to the safe life of propeller components of its make.

4. When a propeller component has served to the limit of the recommended safe life, it should be considered as having reached a stage when full reliance cannot be placed upon inspection, and consequently, it must not be used any more without reference to the manufacturer.

5. Aircraft operators are urged to keep an accurate log of the history of each propeller in their possession, and, as a corollary, are warned against the purchase of second-hand propellers or components with an unknown or unreliable history. It is particularly important that, when a propeller is sent in for repairs and servicing, it should be accompanied by a statement as to its life; otherwise the makers, or their agents, cannot assume responsibility for any pronouncement as to subsequent airworthiness.

6. When considering the matter of safe life of Hamilton Standard adjustable propeller blades and hubs, the subject of severity of service must be taken into account as a distinct factor apart from design characteristics. Such factors as rough plane-engine-propeller combinations, abnormally high cruising R.P.M., propeller overlap, operations from cinder runways tend to decrease the safe life of the propeller. Propellers subjected to severe use should be frequently inspected and serviced to guard against the possibility of tip failures. Blade surfaces should be kept in good condition, and erosion due to water spray or cinders should be promptly removed. When thickness and width for the outer 12″ tip section has been reduced in excess of 10 per cent, blades should be reduced in diameter so as to regain thickness and width within the proper limits, or the blades should be retired from service to prevent a tip failure resulting from flutter.

7. There are certain propeller blades of obsolete design which are more subject to fatigue failure than those of later design. Generally speaking, the older designs may be identified by a rather abrupt change in shape from the cylindrical butt portion to the aerofoil section of the blade.

8. The following Hamilton Standard blades and hub are now considered obsolete by U.S. Department of Commerce and should be discarded:—

Blade	1546	Serial	Numbers	16457	and	16458
"	H1221	"	"	12542	"	12543
Hub	5006	"	"	8849		

9. Air engineers are not to certify as fit for flight aircraft with the above blades and hub after fifteen days from the date of this notice.

APPENDIX

RECOMMENDATIONS OF THE HAMILTON STANDARD COMPANY AS TO THE SAFE LIFE OF PROPELLER COMPONENTS OF THEIR MANUFACTURE

Blades bearing manufacturing numbers 39213 and over could have a safe limit of life of three thousand hours for single engined airplanes and for installation on the centre motor of tri-motored airplanes. For outboard motors the blades should be retired at two thousand five hundred hours.

Blades bearing manufacturing numbers prior to 39213 with the exception of designs noted below should be retired from service after operating two thousand hours in single engined airplanes and on the centre motor of tri-motored airplanes. For outboard motors these blades should be retired at one thousand five hundred hours.

Blade Design	*Recommendation*
***A1C1, ***D7C1½, *2V25, *26V2, *19V2, †5B1, **19B½, *19BO, ***A3A1, ***33C1½, ††17A2, ††43A2, *13BO, †11C1, **2A1, ***7C½, ***1A1.	A safe limit of 3000 hours for single engined airplanes and centre motor installations on tri-motored airplanes. For outboard motor installation this limit should be reduced to 2,500 hours.
***1027, ***1027X, ***1675, ***1887, †††H1207, †1519, ***1803, †1611, ††1503, ***1582, †††27C1, †††1303, †1546, **1105.	Recommend retirement at 2,000 hours. If conditions or records indicate severe service or if they have been bent in accident, we recommend retirement at once.
9C1, 1911.	Blades are old Navy design and experience has indicated that the fairing is conducive to fatigue failures. We would recommend replacing these blades with our design A1C1 which incorporate much better fairing.
***H1425, ***1C1, ***H1407, ††1507.	While these designs are superior to the 9C1, they still incorporate very poor fairing and we would recommend replacing at 1,500 hours, or at once if any of the blades have been involved in an accident necessitating a major repair.

*Not to be used on single row radial engine with bore exceeding 4.375″.
**Not to be used on single row radial engine with bore exceeding 4.875″.
†Not to be used on single row radial engine with bore exceeding 5.19″.
†††Not to be used on single row radial engine with bore exceeding 5.25″.
***Not to be used on single row radial engine with bore exceeding 5.75″.
††Not to be used on single row radial engine with bore exceeding 6.125″.

4. Hubs of the following numbers we recommend a safe life of 3,000 hours.

5406	5408	5407
7033	5413	5414
5404	5903	5976

Hubs of the following number we recommend a safe life of 2,500 hours.
7056 (bore limit 4.875″)

Hubs of the following numbers we recommend a safe life of 2,000 hours.

2450	5006
1518	1595
1693	

(No. 1693 above to be used only on engines with less than 330 H.P.)

Hubs of the following number we recommend a safe life of 1,500 hours.

5131

The following hub, No. 5003, has a tendency to crack along hub spline from centerline of blade out — replace at once.

It is, of course, understood that hubs and blades should not be used on engines having higher horsepowers, r.p.m., or bores than are specified as a maximum by the A.T.C. for the hub and blade in question.

T/1/41 **1941** **25/3/41**
Revised 31/3/48

SAFETY HARNESS, SAFETY BELTS AND LAP STRAPS

1. All aircraft constructors, operators, owners and air engineers are informed that it is a condition of airworthiness that all aircraft operated in accordance with conditions applicable to the normal category must be provided with safety belts for every seat which is for the use of persons performing the duty of piloting the aircraft, and lap straps or their equivalent for every other seat in the aircraft.

2. In aircraft being operated in accordance with conditions applicable to the acrobatic category, an approved type of safety harness must be provided for every seat of the aircraft.

3. Seats or chairs in cabin aircraft must be firmly secured in place.

4. A new ruling permits U.S. built aircraft of the normal category of 4,000 lbs. and less, to spin. Such aircraft will not be required to be equipped with safety harness unless they are used for practice flight involving recovery from spins by reference to instruments only, in which case safety harness must be fitted and worn.

1942

T/1/42 **20/2/42**

CABIN HEATERS — INSPECTION

1. Information Circular T/21/34 brings to the attention of aircraft operators the necessity of frequent inspection of cabin heaters of the hot-air exhaust type, so as to ensure that the heaters are functioning properly and are not introducing exhaust fumes into the cabins. To preclude such a serious hazard, great care must be exercised in the servicing and maintenance of the heaters.

2. In addition to the danger of carbon monoxide poisoning which may result due to defective heaters, there is also the possibility of carbon monoxide being introduced into the cabins of aircraft if oil is permitted to enter the hot intensifier tubes of such heaters. If oil comes in contact with the hot tubes, the resulting decomposition of the oil will give rise to carbon dioxide and carbon monoxide. The percentage of carbon monoxide formed will depend on the temperature and the amount of oxygen present. Typical calculations show that the amount of oil required to form a lethal dose of carbon monoxide under favourable conditions, for a medium sized closed cabin, is small, only about a dozen drops of oil in the intensifier tubes may be ample to cause death.

3. All concerned are therefore warned to keep all parts of the cabin heaters, such as the "On-off" control valves and intensifier tubes free from grease and oil.

REJECTED AND NON-REPAIRABLE METAL PROPELLERS

The following propeller blades and hubs have been listed by the Civil Aeronautics Administration, Washington, as not airworthy for use on aircraft, and aircraft on which such propellers are fitted are not to be considered airworthy. (Superseding all previous lists.)

Rejected Propellers

Manufacturer	*Model*	*Approval No.*	*Serial No.*
Ham. Std. (blade)	A1C1	308	14522.
"	5B1	314	17986, 18643, 21512, 27346, 27347, 29406, 34940, 34941, 37127, 37137, 37138, 41997, 41998, 55418.
"	19V2	342	27384, 27431, 33041, 34706.
"	25V2	352	22741, 22742, 23597, 25842, 35837, 35838, 48987, 48988, 54193, 54194, 78197.
"	1027-X	312	9672, 9789, 14168, 14169.
"	1101	2-61	11253.
"	1103	2-61	2646, 6762, 11518, 11519, 11961, 11962.
"	H1105	2-61	12738, 13642, 13643.
"	H1207	296	11182, 11183, 11187, 11188, 11189, 11636.
"	1219	296	14832.
"	H1221	298	12542, 12543, 13954, 13955, 15290, 38213, 38214, 39628.
"	1519	314	2801, 2943, 2944, 3071, 3076, 3284, 3626, 5688, 7372, 7373, 8316, 9095, 9096, 10402, 10642, 10779, 10780, 10862, 11538, 13972, 19940, 14840, 14841.
"	1546	314	13460, 15869, 16435, 16436, 16457, 16458, 16647, 17137, 17632, 17935, 18046, 19796, 19797.
"	1548	314	17935.
"	1567	306	A360, A361.
"	1605	348	12129, 12130.
"	1611	326	9049, 9050, 16793, 16794.
"	1823	340	14690, 14691.
"	1825	340	14591.
"	1827	328	16969, 16970, 17235, 17236.
"	1875	314	17141, 17142.
"	1897	340	14628, 14629.
"	1915	306	13707.
Ham. Std. (hub)	1667	213	4923.
"	1671	200	5328.
"	1693	193	6100, 6933, 7356, 7465, 8814, 8815, 8566, 8570, 8910, 9639, 10464, 10827, 11672, 12852.
"	5006	196	7942, 8948, 8849, 9035, 9158, 9717, 11723, 16613.
"	5109	2-62	5199, 5970, 6735, 16649.
"	5131	198	16487, 16881.
"	7005	227	12769, 14430, 16831.
"	7020	235	13017.
"	7029	239	12469, 12473, 13581, 13586.
"	7056	613	20887.

Non-Repairable Propellers

Model	*Approval No.*	*Model*	*Approval No.*	*Model*	*Approval No.*	*Model*	*Approval No.*
9C1	320	1503	25	1815	320	1909	320
9C1½	322	1529	25	1819	320	1911	320
9C2	324	1558	322	1841	320	1917	324
1407	4	1574	320	1863	320	1943	320
1409	5	1582	320	1865	320	1961	320
1425	4	1586	324	1905	320	3009	324

The following additional propeller blades and hubs were previously rejected by the U. S. authorities.

Manufacturer	*Model*	*Approval No.*	*Serial Nos.*
Curtiss (blade)	32909	2-70	M568, M672.
"	33570	132	2338.
"	33570-63	132	2344.
"	55503	186	M5009.
Ham. Std. (blade)	11C1-4	326	22807.
Ham. Std. (hub)	1518	187	1182, 1197, 1300, 4007, 4015, 4039, 4510, 4665, 4843, 5027, 5037, 5175, 5392, 5582, 7075.
"	1595	207	4780, 6907, 7255, 7356, 8269, 9786, 23768, 24991.
"	1693	193	6933, 7356, 8814, 8815.
"	S-8460-N	207	22634.

1945

T/1/45 **6/7/45**

AIRCRAFT AND ENGINE COMPONENTS — RELEASE CERTIFICATES

1. Attention is drawn to the importance attached by this Department to strict compliance with the requirements of Information Circular No. T/22/38, particularly in the matter of Inspection Release Certificates.

2. Cases have been brought to the attention of this Department where components imported from abroad have not been accompanied by the documentary evidence of airworthiness issued by the competent authority of the country of origin as required by Paragraph 20 of the above mentioned circular.

1946

T/1/46 **18/6/46**
Revised 31/3/48

LIGHT ALLOY PROPELLERS MAINTENANCE AND INSPECTION

When aircraft are submitted for renewal of Certificates of Airworthiness, the owners will be required to show that the propellers, if of light alloy material, have been proved airworthy by some form of adequate inspection and/or test.

For the information of owners and operators of such aircraft, the following instructions, which are considered to reflect the best knowledge at present available on the subject, are issued.

MAINTENANCE AND INSPECTION LIGHT ALLOY PROPELLERS

1. Introduction

In the paras. and sub-paras. dealing only with light alloys, these instructions are applicable to all types of propellers in which this material is used for the manufacture of the blades. The particular application of the remaining paras. is self evident.

2. Handling

These propellers are easily thrown out of track if subjected to rough handling. During removal from packing cases and whenever it is necessary to lift them, the hold is to be applied to the thicker sections and not at the blade tips. Bumping of the tips on the floor or in any manner is to be avoided.

3. Installation

(a) Check condition of propeller shaft and bore of propeller hub.

(b) When shaft is splined, check angular back lash which is not to be more than 8 minutes. This is equivalent to .003 inches in the splines of a Wasp shaft.

(c) Check thrust nut on engine for tightness, clean shaft threads and splines thoroughly, removing all nicks, burrs, and galls from the shaft and face of thrust nut. Caution should be taken to note that the threads on the shaft are not burred or pulled.

(d) Check condition of centering cones and corresponding seating in propeller hub. Remove proud spots by local stoning, or with the tip of a small file. Match the fit of the cones by means of "marking". Cones are to be reground or replaced if their condition is not good.

(e) When shaft is tapered, check fit of hub and ensure that good contact, heavier on the larger diameter and lighter on the smaller diameter, is obtained. Proud spots caused by previous chafing are to be removed by local stoning. Discretion must be exercised to avoid spoiling a good shaft by fitting an incorrect or otherwise unserviceable hub to it. Check fit of key, with particular regard to clearance on the top.

(f) Thoroughly clean threads and apply an approved anti-seize compound to threads on shaft and in the nut, and a light coating of engine lubricating oil on the splines.

(g) The propeller retaining nut is to be tightened up firmly. The length of leverage necessary will vary with the size of the propeller. A short handled wrench and heavy hammering does not provide the mechanic with a true estimate of tightness, and also damages the thrust bearing. Swinging on an excessively long wrench is also unsatisfactory and can result in enormous stresses in the propeller shaft. A three-foot wrench on a Wasp should provide sufficient leverage with the help of lighter hammer blows to give vibrationary assistance.

(h) Hamilton propeller model 2B20-229 can only be used on Crane aircraft having Jacobs engines with serial number 4318 or upwards.

4. Inspection

An inspection of blades and hub is to be made daily before flight for the detection of damage and the initial stages of cracks. Defective propellers are to be dealt with as follows:

(a) Adjustable propellers if cracked in hub or blade are to be made "unserviceable" immediately. Examine the back of the hub and the shank of the blade on the trailing side, as this is where known instances of failure have commenced.

(b) Nicked blades are to be carefully examined in the vicinity of the damage. When the damage is slight, (3/32 in. on the edge or 1/16 in. on face or back) and the appearance of the material in the vicinity is satisfactory, the propeller may continue in service. The surrounding material should be eased away by file and polished, without further undercutting, to remove the abrupt change of section caused by the damage. Do not repolish at subsequent inspections as this will obliterate the surface condition which the process is intended to manifest. Immediate steps are to be taken to obtain replacements for propellers with badly nicked blades, and the first signs of cracks in the hub or in the blades.

5. Maintenance (Service)

(a) The manufacturer's handbooks are to be consulted at all times for operation and maintenance instructions of particular types. This is especially applicable in the case of hydromatic and electrically controlled propellers of high output.

(b) On newly fitted propellers the tightness of the propeller securing nut is to be checked immediately after the first flight.

(c) On Fairey Reed propellers the tightness of the hub bolts is to be similarly checked, and at the times specified in the relevant Maintenance Schedule.

(d) Rough running of engines, except where other causes can be definitely identified, are to be investigated by inspection of blades for change of setting, and removal of the propeller for checking engine thrust nut, splines and cones. If rough running persists with a new or repaired propeller, and the trouble cannot be identified with any of the causes mentioned and provided the static balance of the propeller is found to be correct, it is to be forwarded to an approved propeller repair Depot.

(e) Where the leading edges of the propeller blades have any pitting, they are to be burnished, employing a light dead smooth cylindrical piece of steel. Finish with crocus cloth to remove any minor projections. No attempt is to be made to remove the small hollows that remain.

(f) On propellers operated over salt water (at the coast) the smoothing of the leading edges is to be carried out at frequent intervals, and the blades wiped with a soft cloth well dampened with approved grease, every day after flight. The result of salt water corrosion is intercrystalline and cracks attributable to this cause have been noted.

(g) Before installation or removal of any propeller, the aircraft is to be placed on a horizontal or flying position, and proper slinging equipment used. Care is to be taken in fitting propellers to have the threads, both on the propeller shaft and on the hub nut or piston absolutely clean and free from dirt or grit before commencing to fit the propeller. Grit and particles of metal left on these threads may cause a partial seizure of the propeller hub nut on the engine crankshaft.

6. Overhaul — Adjustable, Controllable Pitch and Constant Speed Propellers

(a) Repairs to this type can be classed under four headings:—

(1) Replacement of components.

(2) Removal of tip and leading edge damage.

(3) Correction of slight bends in blades.

(4) Correction of more severe bends.

(b) Hubs are machined in pairs and are to be replaced by pairs, when either the front or the rear portion of the original hub is unserviceable. Unserviceable blades may be replaced by new blades or preferably by other serviceable blades with similar flying hours of service. In each instance the blades are to be matched in length, profile and balance.

(c) It has not been possible to set definite limits for permissible reduction in diameter but 2 per cent of this dimension may be taken as a general limit. It has been found that reduction by this amount does not affect the performance of the propeller to a material extent. When slight change of pitch is necessary, it is useful to know that a difference of 1¼ r.p.m. (approx.) results from a change of one minute in pitch angle.

(d) Bent blades are repairable when the bend is not nearer the shank than the mid-section and when the curvature is such that the surface of the blade on the outside of the bend shows no signs of strain. These repairs are outside the scope of the ordinary repair stations as a special screw press is required, the ordinary arbor press being unsuitable by not providing sufficient control to prevent overcorrection. The operator also needs experience and constant practice, as well as facilities for heat treating blades except in instances of very minor bends.

(e) Propellers having bent blades are to be shipped to an approved propeller repair Depot.

7. Fairey Reed Propellers (Repairs)

(a) Fairey Reed propellers requiring repair, other than the trimming of tips and leading edges, are to be shipped to an approved propeller repair depot. (see I.C. T/1/37).

(b) Special tools are required for setting pitch angles on this type.

8. Spinners

Spinners are to be balanced with the propellers to which they will be assembled in service.

9. Etching

For use on light alloy propeller blades, during inspection, to increase the visibility of fatigue cracks, corrosion cracks and other minute defects which may be present on shank or blade.

(a) The etching of propellers by means of corrosive chemicals to facilitate the detection of minute defects is not to be considered as a routine inspection process, but as a last resort when all other aids to visual inspection have failed, and when a well founded doubt as to the airworthiness of a propeller still exists. Abnormally severe conditions of operation such as frequent and fairly continuous high speed use or protracted rough running may constitute grounds for reasonable doubt.

(b) Etching of propellers is not to be done by other than approved Repair Depots except with the special authority of Headquarters.

(c) For complete immersion, suitable tanks constructed of wood, glass or earthenware are preferable, although a steel tank will be found satisfactory for the etching bath.

(d) The etching re-agent is to be made by dissolving 1½ lbs. commercial caustic soda in each gallon of water to form a 15 per cent solution by weight.

(e) The neutralizing agent is to consist of a solution containing 5 per cent by weight of nitric acid (approximately 2½ pints of commercial nitric acid in 5 gallons of water).

(f) The blade requiring inspection is to be first cleaned with acetone or by a 15 to 30 minute immersion in boiling cleaner or suitable concentration for use on aluminum alloy parts. Paint and dirt is to be eased off with fibre brush or rag swab. Wire brushing or scraping is not to be used as these methods not only damage the surface but obliterate the evidence which the process is intended to reveal.

Etching may be effected by complete immersion of the blade or by swabbing with the caustic solution, care being taken to avoid damaging the hands. The etching bath is more effective if heated to a temperature between 60° and 70°C. (140° to 160° F.) Electric immersion heaters have been found to be troublesome, and where the container is made of steel a flame underneath is satisfactory. A sufficient depth of etch should be obtained by immersion for 2½ minutes in the warm solution and longer period, not in any case to exceed six minutes, in the cold solution. After etching, the blade is to be rinsed immediately with water and swabbed with the nitric acid solution until it is white and all traces of the black deposit have been removed — wash and dry.

(g) The blade is then to be inspected all over with a magnifying glass. Particular care is to be taken when inspecting the shank, and the vicinity of recent or earlier damage to leading edge of surface.

(h) It is essential that the blades be polished after etching. This removes the layer of material which has been attached by the etching agent, and the "cold work" of polishing adds to the strength of the material. The polishing operation should follow the length of the blade so that any cracks which may develop will be most easily detected.

10. Magnafluxing

At each overhaul period the ferrous parts of the hubs are to be examined for cracks by magnafluxing. Entries are to be made in the *Propeller Log Book* as to the results obtained. A nil result is to be recorded.

11. Setting of Blade Angles

(a) The approved pitch setting of adjustable propellers should be obtained by reference to the relevant A.T.C. or the aircraft manufacturer. These settings are not to be changed without authority from the Aeronautical Engineering Branch of the Department of Transport and criticisms should be submitted through these channels. Except in emergency, blade settings are not to be adjusted or blades replaced in the field except by qualified engineers, owing to the difficulty in providing the accuracy of blade angle and balance necessary for satisfactory operation.

(b) The angles of blades on any adjustable propellers are to be equal within a limit of six minutes at corresponding stations.

(c) The permissible limits of blade angles on new Fairey Reed propellers are plus or minus 1° at stations on the inner third and plus or minus ½° at stations on the outer two thirds, and and the difference in angles at similar stations on opposite blades is not to exceed 1° and ½° respectively.

(d) Care is to be taken to ensure that the thrust collars of adjustable blades are in contact with the corresponding faces in the hub.

12. Track

The permissible limits of track of the blade tips measured from a datum plane containing the axes of the blade shanks, on adjustable propellers; or the centre of the blade sheet measured at the hub on Fairey Reed propellers, are:

DIA (Up to)	7 ft.	9 ft.	11 ft.
NEW	1/32	3/64	1/16
SERVICE	3/32	7/64	1/8

Note:—The difference between track of respective blades may be twice the amount shown in this table.

13. Balancing

The permissible error in static balance of the complete propeller is 1 inch ounce and balancing equipment is to be maintained in a condition to provide this degree of accuracy. During the balancing of propellers which are keyed to taper propeller shafts in service, a half key is to be used in the key way in the hub to reproduce the correct assembly condition.

14. Marking

(a) Dates of re-etching are to be stamped on the butt of the blade, if necessary the end chamfer may be utilized for this purpose. The blades are not to be stamped in any other location.

(b) A paint mark is to be placed in the angle between blade and hub, after setting, to provide a "Witness" against accidental or other change in setting.

(c) Blade drawing numbers, dates of last re-etching and repair setting, and aircraft and engine types, are to be written on the blades after assembly and the inscription protected with a coat of varnish. It is not expected that this inscription will remain on permanently, but it will provide a direct means of information for Stores purposes, and log book notation.

15. Records

A record of receipts, transfers, installation, etchings, inspections, blade angle settings, changes of blades or hub, repairs and hours run, is to be kept in the appropriate propeller log book. In general, the first number and letter of the Hamilton Standard blade symbol refer to the basic blade design; the third number refers to the size of the shank; minus nought means that the blade forging has been used at its maximum diameter; minus any number means that the blade diameter has been reduced by that number of inches; and the addition of a letter after the number refers to some change in the pitch angles to accommodate a change of V/ND ratio.

16. Storage

Propellers are to be stored in their packing cases or supported on pegs through the centre of the hubs.

17. Replacements

Owners and operators are to anticipate requirements of spare propellers for the replacement of those which will have to be shipped for periodic re-etching and inspection.

SUMMARY OF PROPELLERS

Aircraft	Engine	A/S Type	Blade Drawing	Hub Drawing	Diameter	Pitch or Blade Angle	At Radius
Barkley-Grow	Wasp Jr. SB	H.S.M.2.CS	6095A–12	2D30–209	8′ –6″		42″
Beechcraft 18B	Jacobs L–5MB	H.S.M.2.VP	6135A–9	2B20–213	8′ –3″		42″
Beechcraft 18D	Jacobs L–6MB	H.S.M.2.VP	6135A–9	2B20–209	8′ –3″		42″
Boeing 247D	Wasp SIHI–G	H.S.M.3.VP	6101A–0	3D40–219	10′ –2″	High 35°	42″
Dragon Fly	Gipsy Major	A.C.W.2.SC	5250/BX		6′ –4″	5′ –2″	
Fairchild 24K	Ranger 6–410–B1A	Sensenich W–2	86B1		6′ –0″		
Fairchild 24H	Ranger 6–390–D3	Hartzell W.2	729C		6′ –0″		
Fairchild 71	Wasp A Wasp B Wasp C Wasp Jr. Wright J6R975D Wright J6R975E	H.S.M. 2	7C 150	G5406	(8′ –10½″ (9′ –6″		42″

SUMMARY OF PROPELLERS

Aircraft	Engine	A/S Type	Blade Drawing	Hub Drawing	Diameter	Pitch or Blade Angle	At Radius
Lockheed 10A	Wasp Jr. SB						
Lockheed 10B	Wasp Jr. SB		(6101A			High 25°00′	
Lockheed 12	Wasp Jr. SB	H.S.M.2.CS	(6095A	2D30–211	8′ –6″	Low 13°00′	
Lockheed 12A	Wasp Jr. SB	H.S.M.2.CS	6095A	2D30–211	8′ –6″	High 25°00′	
Lockheed 212	Wasp Jr. SB					Low 13°00′	
Norseman IV	Wasp S3H1	H.S.M.2.VP	6101A–6	12D40–217	9′6″	High 18°00′	42″
						Low 12°00′	
Stinson 105	Continental A–80						
	Continental A–75	Gardener					
		Des. #491			5′ –10″		
Tiger Moth	Gipsy Major	S&S.W.2	120D		6′ –6″	4′ –6.3″	.70R
	Gipsy Major	LL.W.2	5220/SC		6′ –4″	4′ –5″	.70R
			5220/L		6′ –4″	4′ –9″	.70R
			5220/V		6′ –4″		

LEGEND

ACW	— Airscrew Co. — Wooden	RW	— Rotol — Wooden
HSM	— Hamilton Standard — Metal	2	— 2 Bladed
S&SW	— S&S Aircraft Co. — Wooden	SC	— Schwarz Finish
LLW	— Laidlaw Lumber Co. — Wooden	H	— Hydromatic

T/2/46 **24/6/46**

PORTABLE FIRE EXTINGUISHERS IN AIRCRAFT

1. All aircraft registered in Canada including private aircraft and those imported into Canada must be equipped with at least one approved type portable fire extinguisher installed within easy reach of the pilot and co-pilot.

2. This requirement is mandatory in Canada and will be subject to review following the formulation and acceptance of International Airworthiness Standards.

T/4/46 **30/9/46**
Revised 28/7/47

LOCKING OF FLYING CONTROL SURFACES

For all aeroplanes licensed for civil use in Canada, when a device is provided for locking a control surface while the aeroplane is on the ground or water, compliance with the following requirements must be observed after the dates quoted below:—

(a) The locking device shall be so installed as to provide unmistakable warning to the pilot while the lock is engaged. (*Effective Oct. 31st, 1946*)

(b) It shall be impossible for the lock to become inadvertently engaged during flight. (*Effective Oct. 31st, 1946*)

(c) It shall be impossible for the aeroplane to take-off with the lock engaged. (*Effective Aug. 31st, 1947*)

T/5/46 28/10/46

FIRE PREVENTION IN AIRCRAFT — CABIN COMPARTMENTS

For all civil aircraft certificated in Canada after November 1st, 1946, the wall and ceiling linings, covering of all upholstery, floors and furnishings in compartments in which smoking is permitted must be made sufficiently flame-resistant to preclude ignition by cigarettes or matches, and ash trays of the self-contained type which are completely removable must be provided. All other compartments must be placarded against smoking.

Manufacturers are also warned that, for fire prevention in aircraft, the contents of C.A.A. Civil Air Regulations Amendment 0-41 are coincident with the opinions of Canadian authorities and it is anticipated that similar regulations will be enforced in the near future for scheduled air transport operations.

1947

T/1/47 28/1/47

CESSNA T 50 — UNDERCARRIAGE BOLT FAILURE

Several instances of failure of the bolts attaching the Bracket-Landing Gear Screw Yoke have recently occurred.

Owners and operators of this type aircraft are advised to inspect the bolts in question at the earliest opportunity. The bolts which fail are to *AN Specification*, heat treated to approximately 140,000 lbs. per sq. in., whereas the correct bolts for this attachment are special high tensile, heat treated to 180,000 lbs. per sq. in., and may be identified by a specially shaped head.

The parts affected are shown in the *Erection and Maintenance Instructions, Revision to Technical Order No. 01-125-2*, dated August 15th, 1943, revised November 5th, 1944. The correct bolts are Part No. 55382 referred to on page 161 of this publication under the heading "Table of heat treated parts" and the item to which they apply is the Bracket-Landing Gear Screw Yoke, old type Part No. 014106-3 and new type Part No. 50355-18 shown on pages 68 and 69 of the same publication.

T/2/47 6/5/47

CANSO A — EMERGENCY EXITS

1. When taking-off, landing and taxiing on water, the doors in the watertight bulkheads of the *Canso A* aircraft must be kept closed, thereby dividing the hull into five watertight compartments.

2. Where passenger seats or benches are installed in any compartment, the arrangement of emergency exits in that compartment must fulfil the requirements specified in United States Civil Air Regulations, Part 04b, Sections 04.3812, 04.38120 and 04.38121.

The minimum number of exits required per compartment is as follows:

Number of persons for which seats are provided	*Minimum number of exits required*
5 or less	1
Exceeding 5, not exceeding 15	2

3. Effective immediately, the number of passengers carried in any compartment must be restricted to the number permitted by the existing arrangement of exits in that compartment as indicated in paragraph 2 above, and any excess seats should be removed or placarded against use until such time as more adequate exit facilities are provided.

T/3/47 **18/7/47**

FAIRCHILD M62A-3 (FAIRCHILD CORNELL)

1. The Fairchild Cornell aircraft was originally approved for civil use in Canada by this Department at a gross weight of 2,750 lbs., landplane only, based on R.C.A.F. structural strength and performance investigations.

2. Subsequently the U.S., C.A.A. Aircraft Specification A-724-6, dated February 19th, 1947, was issued which allows a gross weight of 2,800 lbs. for the PT-26 and PT-26A (Model M62A-3) provided the rudder and elevator control system springs (Fairchild Drawing 62177) are incorporated, and provided the aircraft is placarded: "Intentional spinning with flaps extended prohibited". The above aircraft may also be operated without the rudder and elevator control system springs but at a gross weight of 2,450 lbs. and provided the aircraft is placarded: "Intentional spinning prohibited".

3. The attention of all concerned is directed to the contents of paragraph 2 above, as certification in Canada of the Fairchild M62A-3 aircraft will now be based on compliance with C.A.A. Aircraft Specification A-724-6, dated February 19th, 1947, and subsequent amendments, plus the centre section front spar modification promulgated in R.C.A.F. Technical Equipment Order E.1./50/54.

T/4/47 **16/8/47**

FLEET CANUCK — FUEL STRAINER MODIFICATION

The attention of all air engineers and owners of Fleet Canuck aircraft is drawn to Fleet Service Bulletin No. 13, Supplement Sheet No. 3, regarding cases of failure of the glass bowl of the fuel strainer which had occurred both in flight and while the aircraft was on the ground.

Additional failures of glass fuel strainer bowls have now been reported and no further flying of the Fleet Canuck aircraft is to be carried out until the above modification has been completed.

T/5/47 **30/9/47**

SURPLUS MILITARY AIRCRAFT, AERO-ENGINES, COMPONENT PARTS, INSTRUMENTS AND ACCESSORIES

1. In order to consolidate and bring up to date the requirements contained in Inspection Instruction No. 175R, Information Circulars 0/29/45, 0/30/46 and Addenda Nos. 1 and 2 to T/22/38, these are now cancelled and superseded by the requirements contained in the succeeding paragraphs.

2. Aircraft Requiring a Canadian C. of A.

(a) Any surplus military aircraft acquired for civil use must be covered by documentary evidence to substantiate that an approved Type Certificate of Airworthiness has been issued by the country of origin for the aircraft in question. For all surplus aircraft acquired from the R.C.A.F., log books will be provided and these will vouch for the serviceability of the aircraft in question up to the time of disposal *to* the War Assets Corporation.

In addition, an Inspection Release Certificate, relating to the specific aircraft, must be issued by a qualified Aircraft Mechanic who has been duly approved by the Department of Transport and is the holder of the relevant Air Engineer Certificate in good standing. This certificate vouches for the airworthiness of the aircraft at the time application is made for civil registration.

(b) Numerous aircraft types entitled to civil certificates of airworthiness have been adapted for military use and, as such, have been frequently modified and often stripped of many refinements provided in passenger-carrying aircraft. Applications have been and are being received for registration of many of these aircraft following reconversion to civil type, and to be eligible they should be returned to their original structure with substantially the same refinements.

In certain instances, concessions in interior design have been granted when such aircraft have been reconverted for civil registry and the use contemplated is either wholly the carriage of freight or in special cases, when passengers and freight are carried on a contractual basis and the lack of such refinements is acceptable to the users of the service.

When a licence under Part II of the Aeronautics Act is in force and passengers are carried, such aircraft must be refitted in accordance with the certification for civil aircraft and deviation therefrom will only be permitted when conditions existing over a given route or area allow such a derogation or modification.

3. Aircraft not requiring a Canadian C. of A.

A number of surplus military aircraft have been, and are being purchased through the War Assets Corporation for export by air to foreign countries without being licensed in Canada or issued with a Canadian Certificate of Airworthiness. In order to protect the present high prestige of the Canadian aviation industry the Department of Transport requires, in future, that such aircraft, before being exported, be certified as being "Serviceable Surplus Military Aircraft".

Such a Certification will not imply that any aircraft in question complies with Canadian Civil Airworthiness standards but will mean that:—

(a) The construction of the aircraft is sound throughout and the engines are functioning normally.

(b) No unauthorized modification affecting the safety qualities of the aircraft have been incorporated since disposal by the military authorities.

(c) Repairs to the primary structure incorporated since disposal by the military authorities are in accordance with a recognized repair scheme, or have received the concurrence of a qualified engineer. In either case full details must be shown in the appropriate log book.

(d) Satisfactory controllability and stability of the aircraft have been proved by a brief flight test at the stated gross weight.

In order to ensure within reasonable limits that any surplus military aircraft is serviceable before being exported from Canada —

(a) The airframe must be inspected and, if necessary, overhauled under the supervision of a licensed "B" Air Engineer.

(b) The engines must be inspected and certified as being serviceable by a licensed "D" Air Engineer.

(c) The complete aircraft must be certified as being serviceable before flight by a qualified Air Engineer in the "A" and "C" Categories.

If the certificates held by the above stated Air Engineers are not endorsed for the particular type of airframe and/or engines, it will be acceptable that authority is held for comparable types, this being confirmed in writing by the local District Inspector, Air Regulations.

It follows from the above that the equipment available to the Air Engineers responsible for the certification of any overhaul work must be equivalent to that of an aircraft overhaul depot recognized by the Department of Transport. Furthermore, in order that release for delivery flight may be ensured, the local office of the Civil Aviation Division must be promptly advised of any intention to overhaul surplus military aircraft.

The above requirements are effective forthwith and a copy of this Circular, together with Air Engineers' and Pilot's certification, must be carried on board the aircraft on departure from Canada.

CERTIFICATION OF SERVICEABLE SURPLUS MILITARY AIRCRAFT

Aircraft Identification Markings Displayed.....

Aircraft Manufacturer.....Aircraft Type.....

Manufacturer's Serial Number.....

Engine Manufacturer.....Engine Type.....

Manufacturer's Serial Number.....

The above aircraft has been inspected in accordance with accepted practice and to the best of our knowledge and belief is serviceable.

.....
Air Engineer Category "B"

Licence No.....

.....
Air Engineer Category "D"

Licence No.....

.....
Air Engineer Categories "A" & "C"

Licence No.....

Aircraft test flown at a total all up weight of.....lbs. and found satisfactory.

.....
Test Pilot

Pilot's Licence No.....

4. Unused Engines

New engines acquired from military sources for use in civil aircraft in Canada are to be accompanied by acceptance test reports and certified by authorized military inspectors. When no log book is provided with the engine, the acceptance test report and certificate should be forwarded, as soon as possible, to the accredited Canadian agent who, on the basis of such documentary evidence of airworthiness, will issue a Canadian engine log book.

5. Used Engines

For any used engine purchased from military sources for use in civil aircraft in Canada, compliance with either condition "A" or condition "B" below is essential:—

(a) *Condition "A"*

(1) Submission of a complete engineering history of the engine, including and since last overhaul.

(2) Certification by an authorized Inspector stating that the engine is serviceable and that, during any previous overhaul only new parts have been installed.

(b) *Condition "B"*

In the absence of full compliance with Condition "A" the engine must be overhauled and certified by either the original engine manufacturer, or his accredited Canadian agent, or any authorized engine overhaul depot in which the equipment and knowledge of the engine model involved are at least equal to the standards established by the accredited agent.

Inspection Release Certificates for engines subsequent to overhaul and having a complete historical record will be prepared in accordance with the Department of Transport Form A.I. — 6 Issue 3.

However, in the case of engines acquired from military sources and not complying with Condition "A", the wording "and no parts of unknown history have been fitted" may be deleted from the Inspection Release Certificate and the declaration below, or its equivalent, substituted:—

"This is to certify that this engine and/or propeller has/have been overhauled in accordance with the recommended procedures and practice of the original manufacturer, which are acceptable to the airworthiness authorities of the country of origin.

All parts have been inspected to the best of our ability and our decisions as to their suitability have, of necessity, been made without the benefit of a complete historical record."

6. Engines — General

Any engine, either used or unused, purchased from R.C.A.F. sources and which has been in storage more than 60 days, must be examined to ensure that the engine has not been affected by corrosion. Any part detrimentally affected by corrosion must be replaced by a corresponding new part.

A used engine acquired from military sources may be installed in new aircraft intended for civil registry in Canada provided the engine has been correctly certified in accordance with Para. 5 above. However, all engine connections and controls must be new.

7. Used Propellers

A used propeller acquired from military sources may be installed in new aircraft intended for civil registry in Canada provided the propeller is correctly certified. Any used propeller of unknown history must be returned to either the original manufacturer, or a repair depot approved by the Department of Transport for this equipment, for inspection overhaul and certification prior to its acceptance.

8. Used Instruments and Accessories

If used instruments (complete) and accessories (complete) acquired from military sources are desired for replacement parts in the overhaul of any aircraft intended for use in Canadian civil air operations, this is permissible provided the accessory or instrument in question has been overhauled and certified by an overhaul depot recognized by the Department for this equipment. Such used items may not be installed in *new* aircraft being manufactured in Canada for civil registry.

9. Parts for Aircraft and Engines

The following requirements apply to parts or items not covered by the preceding paragraphs and which affect the airworthiness or safety of the aircraft:—

(a) For unused aircraft parts or engine parts acquired from the R.C.A.F. for use in civil aircraft in Canada, properly signed release certificates stating that the parts or materials conform to drawings and specifications approved by the Director of Aeronautical Engineering, R.C.A.F., are acceptable to the Department of Transport.

(b) No used aircraft or engine parts acquired from military sources may be used in the overhaul of any aircraft or engine for use in Canadian civil air operations.

10. Aircraft, engines, propellers and equipment disposed of as scrap *must* have all log books (when applicable) and inspection documents destroyed to prevent unauthorized use. Such aircraft, engines and components should be mutilated to prevent being used in an unauthorized capacity. If concrete evidence can be produced that such items or equipment will be used for commercial uses other than civil aviation, then all part numbers and identification plates shall be either removed or obliterated.

T/7/47 **31/10/47**
Revised 30/12/47

REQUIREMENTS FOR IMPORT OF AIRCRAFT INTO AUSTRALIA AND ISSUE OF AUSTRALIAN CERTIFICATE OF AIRWORTHINESS

1. Requirements concerning the importation of aircraft into Australia and the issuance of Australian Certificates of Airworthiness are given in the succeeding paragraphs and must be observed by aircraft manufacturers and owners who desire to export any aircraft from Canada to Australia.

2. Importation

(i) Importer to be in possession of Licence to Import from the Australian Department of Trade and Customs.

(ii) In the case of an assembled aircraft, it must possess a Certificate of Airworthiness for Export, or a Certificate of Airworthiness issued by the appropriate authority in the country of manufacture.

(iii) In the case of an unassembled aircraft, the documents mentioned in para. 3 below are required to be submitted to the Director-General of Civil Aviation when application made for issue of an Australian Certificate of Airworthiness

3. ISSUE OF AUSTRALIAN CERTIFICATE OF AIRWORTHINESS

(a) *Prototype Aircraft*

At time of application for issue of Certificate of Airworthiness, if the aircraft is the *first of its type* to be imported into Australia, the following documents, in addition to the Certificate mentioned in 2. (ii) above, are required to be submitted to the Director-General of Civil Aviation:—

(i) The approved type specification of the country of manufacture, including equipment lists;

(ii) The approved flight manual, maintenance manual, overhaul manual and repair manual of the aircraft;

(iii) The approved operating manual, maintenance manual, overhaul manual and repair manual in respect of each type of engine, propeller and major ancillary equipment fitted to the type;

(iv) An undertaking by the manufacturer that all modifications and service bulletins issued in respect of the type of aircraft, engine, propeller, or equipment will be forwarded to the Director-General at the earliest possible date after issue;

(v) A copy of the flight test report of the particular aircraft, or, if the aircraft is to be imported without having previously been flight tested in the country of manufacture, a copy of the flight test report of a similar aircraft from the production line of the manufacturer suitably endorsed as being the flight test report on an aircraft of a similar model;

(vi) A type record or stress analysis summary showing for all members of the primary structure, their design loads, dimensions, material, strength, and margins of safety, but not including any detailed calculations showing methods of determination of these quantities, or, where the aircraft has received its Certificate of Type Approval on the basis of Static Strength Test Reports, a summary is to be included of the dimensions and materials of the primary structure and the significant margins of safety throughout.

(vii) Drawings of the major assemblies, installations, and primary structure, together with a drawing list; and

(viii) A parts list or schedule of the materials used in each important part of the primary structure and any other components which are heat treated;

(b) *Series Aircraft*

If the aircraft is *not* the first of its type to be imported, the following documents, in addition to the Certificate mentioned in 2. (ii) above, are required:—

(i) A copy of the approved type specification containing details of the equipment actually carried in the aircraft;

(ii) A copy of the flight test report, unless the aircraft is being imported prior to completion of flight tests; and

(iii) Details of all modifications and changes which have been incorporated in that particular aircraft since the issue of the original approved type specification.

1948

T/1/48 **30/1/48**

CANADIAN AIRWORTHINESS REQUIREMENTS FOR SKIS AND SKI INSTALLATIONS

EFFECTIVE DATE: AUGUST 1st, 1948

1. In order to be eligible for Domestic certification for airworthiness, all new type skis and ski installations designed and constructed in Canada shall be shown to comply with the requirements set forth hereunder. These requirements supersede the document entitled, "Requirements for Structural Strength and Approval of Winter Landing Gear" issued by the Department under the date June 17, 1938. This circular is not complete without the following appendices:

Appendix A — I.C.A.O. Recommended Practice.

Appendix B — Interpretation and Application of the Requirements.

Appendix C — Eligibility of U.S. Types, etc.

Appendix D — Approval Procedure.

1.1 The skiplane shall comply with all the requirements applicable to wheel type aeroplanes as set forth in the airworthiness standards to which the type has been designed except in so far as these standards are modified by the following sections. Compliance with each requirement must be provided at the critical combination of aeroplane weight and center of gravity position within the range for which certification is desired.

2. **Skiplane Structural Requirements.** (Applicable only to the axles and structure above the axles).

2.1 The skiplane structure shall meet all the energy absorption and ground load requirements applicable to the type when operating on wheels except that the drag loads on the skis need not exceed 25 per cent of the vertical ground reactions.

2.2 *Torque Load.* As a special skiplane condition, a limit torque load of 0.667W foot pounds shall be applied to the main ski axle about a vertical axis through the center line of the ski and the center line of the axle, where W is the maximum weight of the skiplane in pounds. The required factor of safety is 1.5.

2.3 *Application of Loads.*

(a) The resultant of the vertical ground reaction and the drag loads shall be applied to the axle at a point vertically above the center line of the ski base.

(b) The resultant of the side load shall be applied at the ground line at a point vertically below the center line of the axle.

2.4 *Nose Ski Installations.* The structural requirements applicable to nose ski installations will be the subject of special rulings by the Department.

3. Skis.

3.1 A main ski including its pedestal or equivalent structure shall be approved for a maximum static load P determined on the basis of the ski loading conditions set forth in current I.C.A.O. Airworthiness Standards and Recommended Practices. (See Appendix A attached).

4. Ski Selection and Installation.

4.1 The approved rating of each main ski shall not be less than the maximum weight of the skiplane divided by the number of main skis. When the landing load factor exceeds the value of n used in substantiating the skis this fact should be taken into account in selecting skis.

4.2 A nose ski shall be substantiated in accordance with Section 3, for ultimate loads not less than the maximum nose ski ultimate loads obtained from the ground load requirements.

4.3 Tail skis and pedestals do not need to be approved as components and will not be rated for strength by the Department. It is recommended, however, that they be designed to meet the same strength standards as main skis on the basis of the maximum static load on the tail ski as installed in the aeroplane.

4.4 *Trimming Gear.* The main and nose ski trimming gear and attachments shall meet the requirements set forth in current I.C.A.O. Airworthiness Standards and Recommended Practices. (See Appendix A). Special stabilizing devices will be examined on their merits.

4.5 *Propeller Clearance.* All ground and structural clearance requirements for the landplane shall be met, including propeller clearance when the ski is rotated within its rigging limits with the landing gear in the fully deflected position.

5. Flight and Ground Handling Requirements.

5.1 The skiplane shall meet the flight requirements applicable to the landplane except in so far as these requirements are modified hereunder.

5.2 *Take-Off.* Satisfactory take-off characteristics shall be demonstrated. The skiplane shall be completely controllable throughout the take-off run. The measurement of take-off distance will not be required at present.

5.3 *Landing.* Satisfactory landing characteristics shall be demonstrated. The skiplane shall display no unsafe characteristics, such as tendency to ground loop, and shall be completely controllable throughout the landing. The measurement of landing distance will not be required at present.

5.4 *Ground Handling.* Satisfactory ground handling shall be demonstrated. If brakes or steerable nose or tail skis are fitted they shall be shown to be safe for use in all conditions reasonably expected for the type, and shall impose no undue strain upon the controls or the pilot.

5.5 *Ski Trimming.* (Functional Tests). The skis shall trim satisfactorily in all flight conditions and manœuvres appropriate to the type being tested, including diving at maximum permissible speed.

5.6 *Buffeting.* There shall be no objectionable buffeting or vibration in any flight condition.

5.7 *Performance Reduction.* (Domestic Operations Only). For the purpose of showing compliance with the minimum performance requirements, the flight test results may be corrected on the basis on an assumed *Canadian Standard Winter Atmosphere* defined as follows:

Pressure Variation With Altitude. Same as International Standard.

Temperature Variation With Altitude.

(a) Between sea level and 8,500 ft. the temperature is constant at 14° F (–10° C).

(b) Between 8,500 ft. and 25,000 ft. the temperature is reduced with increasing altitude at the standard lapse rate of - .003566° F. per foot.

APPENDIX A

INFORMATION CIRCULAR NO. T/1/48

I.C.A.O. RECOMMENDED PRACTICE CONCERNING THE DESIGN OF SKIS AND SKI TRIMMING GEAR

A.1 The following material is reprinted from P.I.C.A.O. Doc 3031, AIR/181, Proposed 1947 Edition of Airworthiness Standards and Recommended Practices. Doc 3031 paragraph numbering is retained.

"3.5.3 **Skis**

Skis, including ski pedestals, should be approved for a maximum static load P determined on the basis of the following recommendations.

3.5.3.1 *Strength*

The strength of a ski, including its pedestal, cables, and lugs, or mechanical trimming gear, should be substantiated by calculations or by static tests.

3.5.3.2 *Design Loads*

When supported at the pedestal bearing, a ski, including its pedestal, should be capable of carrying the following loads. The factor of safety of at least 1.5 should be applied.

3.5.3.2.1 *Distributed Up Loads*

A load Pn should be applied to the ski bottom and should be distributed uniformly across the ski and extending uniformly from the rear of the ski as far forward as is necessary to bring the centre of pressure at a point one-quarter of the height of the pedestal ahead of the pedestal bearing, where,

P the maximum static load in pounds for which approval is sought, and

$$n \quad 2.80 + \frac{9000}{2P \text{ (lbs.)} + 4000}$$

Equilibrium about the pedestal bearing sleeve should be obtained by applying at the ski bottom a drag load equal to 25% of the vertical load.

3.5.3.2.2 *Concentrated Up Loads*

Vertical loads should be applied at the extreme ends of the skis, the sum of these loads being equal to 1.33P, and the direction of application being perpendicular to the ground line, the total moment about the axle being zero.

3.5.3.2.3 *Distributed Side Load*

A uniformly distributed side load should be applied to the side of the skis, symmetrically disposed with respect to the pedestal bearing in the fore and aft direction. The load on each ski should be 35% of the load used in 3.5.3.2.1

3.5.3.2.4 *Torque Load*

A torque load equal to 1.33P foot pounds should be applied to the ski about the vertical axis through the centre line of the pedestal bearing.

3.5.3.3 *Restraining and Trimming Gear*

An elastic trimming gear should be provided to maintain the ski in an appropriate position during all approved flight conditions. It should have sufficient strength to withstand the maximum aerodynamic and inertia loads sustained by the ski. If information concerning the magnitude of such loads is not available, the gear should be designed for a pitching moment of at least 0.133W foot pounds applied about the pedestal bearing in either direction, where W is the weight of the aeroplane.

A restraining gear should be provided which limits positively the angular travel of the ski to values such as will accommodate the position assumed by the ski when:

(a) the aeroplane encounters an uphill slope, when in a tail up attitude;

(b) the aeroplane encounters a downhill slope, when in a tail down attitude.

It will usually be sufficient to assume that the angle of these slopes is 7½ degrees. The total angular travel of the ski will thus be the landing angle (i.e. the angle between the tail up and tail down attitudes) plus 15 degrees.

This angular travel should be provided with the shock absorber both extended and compressed fully. The restraining gear, and the structure to which the restraining gear is attached, should have sufficient strength to withstand a vertical load equal to 0.8 times the static vertical load on the ski, applied firstly at the fore end of the ski and, secondly, at the aft end of the ski."

Note The specified loads are limit loads. The limit loads should be multiplied by a factor of safety of 1.5 to obtain the ultimate design loads.

APPENDIX B

INFORMATION CIRCULAR NO. T/1/48

INTERPRETATION AND APPLICATION OF THE REQUIREMENTS

B.1 The material contained in this Appendix is intended to assist in the interpretation and application of the requirements.

B.2 **Eligibility of the Aircraft Structure for the Installation of Skis.**

B.2.1 In certain cases the investigation of the skiplane structure may be abbreviated if compliance with some or all of the structural requirements can reasonably be inferred from previous investigations or approvals.

B.2.2 For example, if it is desired to fit skis to an aircraft type which has been approved on wheels, or to fit a different kind of ski gear to a type which has been approved on skis, the energy absorption and ground load requirements of Section 2.1 may be assumed to be met at the previously approved weights if

(a) the energy absorption characteristics of the skiplane landing gear are at least as good as those of the wheel landing gear or previously approved skiplane landing gear; and

(b) the height of the skiplane axle in the static position does not exceed the outside radius of the unloaded tire or the axle height of a previously approved ski installation, whichever is the greater; and

(c) any change in the track of the skiplane as compared with that of the landplane does not increase the bending moment on the axle.

B.2.3 The energy absorption characteristics of the skiplane landing gear may be assumed to be as good as those of the wheel landing gear if the wheel is retained as a shock absorbing element in the skiplane landing gear system or if it is replaced by an element having energy absorption characteristics at least as good as those of the tire.

B.2.4 The tolerance on skiplane axle height allowed by B.2.2. (b) is applicable to all types of aircraft which have been approved on wheels. In the case of Civil Aeronautics Administration approved types, the maximum skiplane axle height which may be used without further substantiation will be that obtained from B.2.2. (b) or the maximum pedestal height quoted in the pertinent Aircraft Specification, whichever is the greater.

B.2.5 *Torque Load Requirement*

(a) If the type has already been approved as a skiplane in Canada the torque load requirement of Section 2.2 may be assumed to be met.

(b) In the case of Civil Aeronautics Administration approved types, compliance with the torque load requirement can usually be determined by referring to the Aircraft Specification as explained in Appendix C, Para. C.2. (b)

B.3 Approval of Skis and Pedestals as Components

The main ski and pedestal assembly will normally be rated and approved as a unit. However, a main ski base may be approved separately if it can be shown to have adequate strength when suitable assumptions are made with respect to pedestal dimensions and locations.

Similarly, a pedestal may be approved separately. Since the side load is applied at the ground line, a suitable thickness of ski base should be assumed when checking the pedestal for side loads.

B.4 Flight Tests for Change of Ski Equipment

Where there is little change in the size and shape of the skis, or in the rigging of a new ski installation, as compared with an installation which has already received approval, and where compliance with some of the flight requirements can reasonably be inferred from the previous approval, abbreviated flight tests may be accepted. The extent of the tests will depend on the nature of the changes.

For example, an aircraft previously approved on skis need not undergo additional flight tests to check its performance and flying qualities when a different type of design of ski is fitted unless it is apparent that there will be an appreciable reduction in performance or change in flight characteristics due to increased drag, etc.

Sections 5.2, 5.3, 5.4, 5.5 and 5.6 of the requirements should be checked in any case.

APPENDIX C

INFORMATION CIRCULAR NO. T/1/48

ELIGIBILITY OF UNITED STATES CIVIL AERONAUTICS ADMINISTRATION APPROVED SKIS AND SKI INSTALLATIONS FOR USE IN CANADA

C.1 Skis

(a) All Civil Aeronautics Administration approved main skis which meet the structural requirements of United States Civil Air Regulations Part 15 in their entirety are eligible for use in Canada.

(b) Civil Aeronautics Administration approved main skis of the type which attach directly to the wheel and tire are not eligible for use in Canada unless the ski-wheel assembly can be shown to meet the side and torque load requirements for skis set forth in CAR Part 15 or in Appendix A of this Circular.

(c) Tail skis manufactured in the United States are eligible for use in Canada without C.A.A. approval.

C.2 Ski Installations

(a) All Civil Aeronautics Administration approved ski installations, excepting those which include main skis of the type referred to in Para. C. 1 (b) above, are eligible for use in Canada without further investigation if the skiplane structure complies with special torque load requirement of CAR 03.246 or of Section 2.2 of this Circular.

(b) Compliance with the torque load requirement may be assumed if any one of the following statements appear in the pertinent Aircraft Specification under "Export Eligibility":

(i) "Canada: Skiplane — Eligible"

(ii) "Canada: Skiplane — not eligible, however structure complies with Canadian Requirements when. . ." (conditions stated).

(iii) "Canada: Skiplane — not eligible, however structure as skiplane is acceptable to Canada since it complies with CAR 03 requirements when. . ." (conditions stated).

APPENDIX D

INFORMATION CIRCULAR NO. T/1/48

APPROVAL PROCEDURE

D.1. To be eligible for airworthiness certification the first example of a new type ski installation, i.e., the prototype ski installation, must receive design approval from the Department. All subsequent installations which conform to the approved design data will be eligible for certification without further investigation.

D.2. *Technical Data.* Applications for the approval of new type skis or ski installations must be supported by such drawings, specifications, computations and test reports as are necessary to define the type design and demonstrate compliance with the relevant airworthiness requirements.

D.3. *Structural Approval.* To be eligible for official flight tests, a prototype ski installation shall first receive structural approval of the design.

D.4. *Ground Inspection.* The prototype installation shall be inspected for conformity with the design drawings and for any design features which may appear to be questionable from the airworthiness point of view.

D.5. *Flight and Ground Handling Tests* shall be conducted under the supervision of the Department.

D.6. *Final approval of the design* will depend on the satisfactory completion of the foregoing investigations.

T/2/48 **2/3/48**

AIRCRAFT EMERGENCY EXITS

1. All aircraft with four passenger seats or less must have an exit additional to the one main cabin door in order to obtain a Canadian Certificate of Airworthiness. This additional exit may be either a second door located at the side opposite the main door, a window frame which could be released and jettisoned, or a fabric panel of sufficient size furnished with a wire ripping device and located in either the top or the side opposite the main door. Any such window must be capable of being released from both the inside and the outside, preferably by means of hinge pins which could be withdrawn easily. In addition, suitable emergency exits must be provided for members of the crew isolated from passenger compartments. The position of every emergency exit must be clearly indicated.

2. Aircraft with more than four passenger seats must have emergency exits complying with the standards contained in the Airworthiness requirements on which the aircraft design is based. The position of every exit (normal as well as emergency) must be clearly marked and the instructions for operating each one must be included in such markings. The operating instructions must be readable and understandable by any person at a distance three feet away, in an emergency at night when all light sources have failed.

3. Emergency exits are approved on the basis of accessibility and functioning. It has been found that an emergency exit could not be opened except by breaking the

glass, whereas the panel was designed to open readily. On close examination it was found that the exit had been permanently fastened by the application of a composition of rubber cement, apparently to exclude leakage.

4. Aircraft operators and air engineers are warned that emergency exits must in no case be altered or fastened in any other manner than that described in the approved drawing and must always remain capable of being opened or broken open without tools, both from the inside and the outside.

T/3/48 **3/3/48**

LOG BOOK ENTRY — AIRCRAFT OVERHAUL AND INSPECTION FOR RENEWAL OF CERTIFICATE OF AIRWORTHINESS

1. In order to unify the system of certification of registered aircraft after overhaul, the following procedure is to be adopted immediately:—

(a) A log book entry is to be made giving details of work done, itemized by components.

(b) The entry, if written by hand, is to commence at the extreme left-hand side of the double log book page, and is to extend across both pages; if typewritten on a separate sheet, the sheet is to be affixed to the right-hand page, and a line drawn on the left-hand page under the last flight entry prior to overhaul.

(c) The following declaration is to be added:—

"I hereby certify that all work listed has been done with certified material according to accepted practice; that all Airworthiness Directives (or equivalent) and Manufacturer's Service Bulletins affecting safety have been complied with to date, that no approved modifications have been incorporated and that the aircraft is airworthy".

Sgd.————————————
Air Engineer "B"

2. When an aircraft has undergone examination for renewal of Certificate of Airworthiness and no major repairs or modifications are found necessary, the following log book entry must be signed by a qualified "B" category air engineer, or in certain circumstances, by a qualified "A" and "C" air engineer:—

"I hereby certify that all Airworthiness Directives (or equivalent) and Manufacturer's Service Bulletins affecting safety have been complied with to date, that no unapproved modifications have been incorporated and that the aircraft is airworthy".

Sgd.————————————
Air Engineer Certificate No.....

3. The signature of a qualified "A" and "C" air engineer is acceptable only in cases where the services of a "B" category air engineer are difficult to obtain and such acceptance is left to the discretion of the District Inspector.

CERTIFICATION OF AIRWORTHINESS FOR EXPORT TO THE UNITED STATES

1. Since the issuance of Information Circular T/2/45, both the United Kingdom and the United States airworthiness requirements have been either completely revised or appreciably amended, necessitating bringing up to date the requirements that must be observed before a Canadian Certificate of Airworthiness for Export to the United States can be issued. Based on advice received from the U.S. Civil Aeronautics Administration, these special conditions are listed in the succeeding paragraphs.

2. Canadian aeroplanes of a type for which an airworthiness certificate has previously been validated by the United States under the terms of the reciprocal agreement will continue to be eligible for a Certificate of Airworthiness for Export to the United States on the same basis which governed the issuance of a Certificate of Airworthiness for Export for previous aeroplanes of the same type.

3. Canadian aeroplanes of a type for which an airworthiness certificate has not been validated by the United States under the terms of the reciprocal agreement will be eligible for a Certificate of Airworthiness for Export to the United States provided compliance with the requirements of either CAR 03 or CAR 04b can be shown.

4. Canadian aeroplanes complying with the airworthiness requirements of the British Air Registration Board, in effect since 1944, will be eligible for a Certificate of Airworthiness for Export to the United States provided compliance with the following sections of the United States Civil Air Regulations can also be shown:—

Transport Category

04b. 12	Performance.
04b. 13	Flight Characteristics.
04b. 25	Water Loads.
04b. 4400	Cooling Tests (hot day) if the aeroplane has been shown to meet only the temperate zone requirements of the A.R.B.
04b. 450	Induction System De-icing.
Amendment 04b–1	(Nov. 1st, 1946) Fire Prevention.
04b. 6	Operating Limitations and Information.

Non-Transport Categories

03.12	Performance.
03.13	Flight Characteristics.
03.2111	Manœuvring Envelope.
03.25	Water Loads.
03.4400	Cooling Tests (hot day) if the aeroplane has been shown to meet only the temperate zone requirements of the A.R.B.
03.450	Induction System De-icing.
03.6	Operating Limitations and Information.

5. Canadian aeroplanes which have been approved under British airworthiness requirements, in effect prior to 1944, shall be shown to comply with U.S. Civil Air Regulations, Part 04b for the transport category, or Part 03 for the non-transport categories, before becoming eligible for a Certificate of Airworthiness for Export to the United States.

6. Regardless of the basis of certification, Canadian aeroplanes exported to the United States must be equipped in accordance with the appropriate operating rules of the U.S. Civil Air Regulations in order to be eligible for a particular class or type of operations. These are listed as follows:—

Part 43 — General Operation Rules

Part 42 — Non-Scheduled Air Carrier Operation Rules.

Part 40 and 61 — Scheduled Air Carrier Rules (Domestic).

Part 41 — Scheduled Air Carrier Rules (Foreign).

7. The above special conditions are effective immediately and will remain in force until further notice. However, it is anticipated that they may be eliminated when the U.K. and the U.S. airworthiness requirements are brought into closer agreement, or when I.C.A.O. Standards applicable to export and import of aircraft are adopted.

APPENDIX

AIR ENGINEER CERTIFICATES

CONDITIONS OF ISSUE AND INSTRUCTIONS TO APPLICANTS

Categories

Air Engineer Certificates will be issued subject to the provisions of Air Regulations for any or all of the following purposes:—

"A"—Inspection of aircraft before flight.

"B"—Inspection of aircraft after overhaul.

"C"—Inspection of aero engines before flight.

"D"—Inspection of aero engines after overhaul.

Qualifications

In order to qualify for an Engineer's Certificate, a candidate must,

(a) Be a British subject, or a subject of a foreign country which grants reciprocal aeronautical privileges to Canadians on equal terms and conditions with subjects of each foreign country.

(b) Not be under 19 years of age.

(c) Satisfy the Minister by examination or otherwise as to his ability.

(d) Be able to demonstrate sufficient ability in the use of appropriate tools and materials that would be necessary to enable him to perform such repairs and replacements as his duties in maintenance of aircraft and/or aircraft engines might require.

(e) Furnish three names and addresses of either

(i) employers engaged in the manufacture of aircraft and/or aircraft engines; or engaged in the operation of aircraft;

(ii) licensed air engineers who can, from personal knowledge, vouch for the proficiency of the candidate in practical aeronautics.

Experience

"A" Candidates for certificates in category "A" will be required to submit proof of having had at least two years' satisfactory experience both on aircraft construction and maintenance, or on maintenance alone.

"B" Candidates for certificates in category "B" will be required to submit proof of having had at least four years' satisfactory experience both on aircraft construction and maintenance, or on construction alone.

"C" Candidates for certificates in category "C" will be required to submit proof of having had at least two years' satisfactory experience both on aero engine construction and maintenance, or on maintenance alone.

"D" Candidates for certificates in category "D" will be required to submit proof of having had at least four years' satisfactory experience both on aero engine construction and maintenance, or on construction alone.

In all categories Certificates will be limited to those types of which the candidate has experience.

School Training

Time spent at technical schools or like institutions may be taken under consideration when assessing experience, and may be permitted to count towards the experience required for an Air Engineer Certificate under the following conditions:—

(a) A student having completed an Air Engineer's course at a technical school or like institution may, on graduation from the school, be credited with the actual hours spent in the aircraft and aero engine shops of the school on practical work. Such time may not exceed a credit of one year, and will apply on "A" and "C" licences only.

(b) A certificate of competency relative to the candidate's qualifications will be accepted from a licensed engineer in the employ of such school, and the hours of practical shop work should be verified by the principal or his assistant.

(c) The balance of the two years' experience required for an Air Engineer Certificate must be completed in full on actual operations under the supervision of a licensed air engineer.

(d) No part of any school work will be admitted as qualifying a candidate for categories "B" or "D".

Applications for Certificates

Application forms may be obtained on request from Civil Aviation Inspectors at the various District offices, or from the Civil Aviation Division, Department of Transport, Ottawa.

Applications for Certificates cannot be considered unless sufficient information is given in either the application or letters of competency concerning the candidate's experience on different makes and models of aircraft and aero engines. Complete details are required, both in the application and letters of competency, stipulating the length of time connected with the aircraft industry on maintenance and/or construction duties and specifying the makes and models on which satisfactory work has been done.

Air engineers may, from time to time, be examined on additional types, and if the examination is satisfactorily passed, the Certificate will be endorsed accordingly. Such examinations may be either oral or written, at the discretion of the examiner.

Examinations

CATEGORY "A" — Inspection of Aircraft before flight.—Applicants must be familiar with the general principles of the systematic maintenance and examination of aircraft before flight, including knowledge of:—

(a) The method of checking the correct assembly of components, the rigging of an erected aircraft and the functioning of the flying controls, together with the correction of faults experienced during flight, the assembly and functioning of the landing gear including the correct rigging of skis, and the method of erection, truing up and maintenance of hulls and floats of wood, metal, or composite construction.

(b) The defects and deterioration in wing coverings, timber and metal members, metal fittings, propellers (wood or metal), streamline wires, tie-rods, cables, shock absorbing devices and other parts of the aircraft structure that may be expected to occur as the result of wear and tear, or may be produced by slight mishaps experienced during normal operations of the aircraft, and a knowledge of the method of effecting minor repairs and replacements.

(c) The method of inspecting and testing the installation of the flying instruments to ensure correct functioning.

(d) Compass adjustment, turn indicator, and electrical services, the method of inspecting and testing of the installation concerned in order to ensure correct functioning.

(e) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.

(f) The entries which must be made in the appropriate log book, and ability to select data and to make other suitable entries to provide a useful history of the aircraft.

(g) Air Regulations in so far as they affect air engineers.

CATEGORY "B" — Inspection of Aircraft after overhaul. — The applicant must be familiar with the general principles of the inspection of aircraft construction, including knowledge of:—

(a) Non-metallic materials and their relative specifications; methods of identification, examination and testing; characteristic defects which render them unsuitable and precautions to be observed in their application to aircraft construction.

(b) Metallic materials and their relative specifications, methods of identification, examination and testing; characteristic defects which render them unsuitable and precautions to be observed during processes of manufacture or repair — (heat treatment, welding, brazing, soldering, plating, etc.).

(c) The method of construction and examination of hulls and floats; effects of corrosion, causes of corrosion and protection against corrosion.

(d) The method of construction, examination and testing of aircraft parts and components — (fuselages, wings, propellers, tanks, radiators, pumps, cocks, etc.) corrosion and its prevention.

(e) The high tensile steels, strong aluminum alloys, etc., and the special workshop processes applicable to the materials used in the particular construction or constructions.

(f) Method of inspecting and testing the complete aircraft for correct assembly, installation of engine, controls, fuel, oil and water systems, cabin heaters, instruments, electrical services and other appliances.

(g) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.

(h) The entries which must be made in the appropriate log book, and ability to select data and to make other suitable entries to provide a useful history of the aircraft.

(i) Air Regulations in so far as they affect air engineers.

CATEGORY "C" — Inspection of Aero Engines before flight. — The applicant must be familiar with the general principles of inspection and testing of aero engine installation and maintenance, including knowledge of:—

(a) The general construction of the particular type or types of engine for which the Certificate is required, together with the running time permissible before overhaul; the method and details of making a partial overhaul for the purpose of carbon removal, valve grinding and inspection, the defects likely to be encountered and the permissible allowances for wear and distortion; the methods of inspection and setting during and after this operation to ensure correct assembly and functioning.

(b) The methods of examining and testing the correct erection of the power plant and its accessories in the aircraft, including the fuel, oil, cooling, ignition, induction and exhaust systems, tanks, pipe lines, engine controls, propeller complete with hub, together with characteristic defects.

(c) The inspection, adjustment and testing of the power plant and its accessories to ensure correct functioning and power output after installation in the aircraft and during daily maintenance, including propellers, magnetos, carburettors, pumps, filters, engine starters and starting mechanisms and other parts or components on whose condition the correct functioning of the power plant depends; causes, effect, and prevention of external and internal corrosion.

(d) The correct grades of oil and other lubricants approved by the engine manufacturer for use on the particular engine or engines and their seasonal application; periods of running between oil changing.

(e) The minimum requirements for the fuel as specified or recommended by the engine manufacturer.

(f) The methods of inspecting and testing the installation of the instruments connected with the power plant concerned to ensure correct functioning, including pressure gauges, temperature and revolution indicators, boost gauges and tank contents gauges.

(g) The method or methods of starting engines in sub-zero temperatures, including precautions to be taken to minimize the risk of fire when naked flames are used during this operation.

(h) For certificate to include supercharged engines, the functioning of superchargers and boost control.

(i) For certificate to include Compression Ignition Engines, the fuel injection system and method of regulation.

(j) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.

(k) The entries which must be made on the appropriate log book, and ability to select data for and to make other suitable entries to provide a useful history of the engine.

(l) Air Regulations in so far as they affect air engineers.

CATEGORY "D" — Inspection of Aero Engines after complete overhaul. The applicant must be familiar with the general principles of the inspection of aero engines during construction and/or complete overhaul including knowledge of—

(a) Materials used in engine construction and their relative specifications, methods of identification, re-examination and testing. Characteristic defects which render them unsuitable and precautions to be observed during processes of manufacture and repair — (heat treatment, white metalling, etching, brazing, soldering, protection against corrosion, etc.) — to ensure that the finished parts are in a satisfactory condition.

(b) The general principles of testing and measurement of horse power, fuel and oil consumption, etc., as applied to aero engines.

(c) The correct grades of oil and other lubricants approved by the engine manufacturer for use on the particular engine or engines and their seasonal application; periods of running between "oil changing"; characteristic defects resulting from incorrect or insufficient lubrication; cause and effect of sludge formation.

(d) The minimum requirements for the fuel as specified or recommended by the engine manufacturer.

(e) The general assembly, adjustment and methods of testing the correct erection of the components of the particular type or types of aero engine for which the certificate is required, including the safe allowances for deterioration, wear, distortion, balancing of parts, etc. The methods of adjustment, repair and testing of carburettors, engine starters, pumps, etc., that are fitted to the particular type of engine and of minor repairs to, and adjustment of, magnetos. Causes, effects and prevention of external and internal corrosion. Protection against corrosion during storage.

(f) The methods of inspecting and checking the correct functioning of the ignition, carburation, lubrication and cooling systems on the engine during tuning up and testing.

(g) For certificates to include supercharged engines, the method of construction, testing and functioning of the supercharger unit and its accessories.

(h) For certificates to include Compression Ignition Engines, the construction of the Fuel Injection System and the methods of fuel regulation.

(i) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.

(j) Entries which must be made in the appropriate log book, and ability to select data for and to make other suitable entries to provide a useful history of the engine.

(k) Air Regulations in so far as they affect air engineers.

PRACTICAL TEST

Tools and Materials

An air engineer in the performance of his duties may, and often will be required to execute various repairs and replacements, for which a certain amount of skill in the manipulation of materials and the use of hand tools is necessary. Candidates must satisfy the examiner that they possess the required skill for this work and may be required to demonstrate this fact by actual tests. These tests will be confined to simple operations as:—

(a) Use of files and scrapers.

(b) Use of measuring instruments.

(c) Marking off and drilling, to drawing.

(d) Bending of sheet metal and tube.

(e) Soldering and brazing.

(f) Use of carpenter's hand tools.

(g) Preparation and use of casein cement.

(h) Sewing of fabric.

(i) Splicing of control cables.

(j) Riveting.

(k) Fitting of Piston Rings.

(l) Valve grinding, etc.

(This does not imply that all repairs to aircraft must be effected by an air engineer. It is permissible for the actual work to be carried out by any competent mechanic, although the result must be passed by an air engineer holding a certificate in the appropriate category, before the aircraft can be accepted as airworthy).

AUTHORITY

(a) *Air Engineer Certificate, Category "A"* authorizes the holder to certify as airworthy any of the types of aircraft endorsed on his certificate, provided:—

(i) That the annual Certificate of Airworthiness for the particular aircraft is in good standing.

(ii) That he is satisfied by adequate and personal inspection that the aircraft is airworthy at the time he records this fact in the aircraft log book.

(b) In addition it authorizes the holder, after adequate inspection, to certify as airworthy any minor repairs and replacements which become necessary to these types of aircraft as the result of normal use.

(c) For the purpose of this instruction, minor repairs and replacements are defined as those which do not affect the strength of the main structural members of the aircraft, except that such members may be replaced only by replacing the complete assembly in which they may occur, in which case the replacement assembly must have been duly certified as airworthy by an air engineer holding the appropriate certificate.

NOTE: (A spar is a main structural member and also forms an integral part of a main assembly. Its repair or replacement must be certified by an air engineer licensed in Category "B". A longeron forms an integral part of the fuselage and the same ruling applies to replacement of these components.

An air engineer, Category "A", may, however, certify the aircraft as airworthy after the satisfactory replacement of the complete assembly containing either of these).

An Air Engineer, Category "B", is authorized to certify as airworthy, after major repairs or complete overhaul, any of the aircraft endorsed on his Certificate provided:—

(a) That the aircraft conforms to the type for which the original Certificate of Airworthiness was issued, with the exception of such modifications as may have been ordered by the Minister in Technical Information Circulars issued by the Controller of Civil Aviation, or otherwise approved.

(b) That he is satisfied by adequate and personal inspection that the strength of other repaired component or components is similar to the strength of the same components when in the new state, and that such repaired components or replacements conform to the approved drawings in material and dimensions excepting:—

(i) That damaged portions of welded steel tube fuselages and of other components of similar construction may be replaced provided that the location and design of the welds conform to established practice for the type of repair, and that the original metallurgical structure of the material has been restored by suitable heat treatment in those components on which heat treatment is a requirement during manufacture.

(ii) That repairs to other forms of construction are similarly in accordance with established practice.

(iii) That repairs to spars and other components as may be specifically directed by Technical Information Circulars conform to sketches or drawings which have been submitted to the Minister and approved by him for each repair.

(c) That he is satisfied by adequate and personal inspection that the aircraft has been assembled correctly, including the installation or insertion of all necessary locking devices as will prevent the accidental separation of any of the components, and that the protection against deterioration is reasonable for the purpose, having in mind the particular conditions under which the aircraft is required or expected to operate.

Air Engineer, Category "C", is authorized to certify as airworthy any of the types of aircraft engines endorsed on his Certificate provided:—

(i) That no modifications to such engines have been made except as directed by the Minister in Technical Information Circulars or otherwise approved.

(ii) That he is satisfied by adequate inspection that the engine is airworthy at the time he records this fact in the appropriate log book.

In addition it authorizes the holder, after adequate inspection, to certify as airworthy all minor repairs, replacements and adjustments which may be required as a result of normal operation, or become apparent during partial overhaul.

Partial overhaul is specified for the purpose of this instruction as:—

(i) Removal of cylinders and attached valve gears for the purpose of carbon removal, valve reseating, etc., and general inspection not requiring the complete dismantling of the engine.

(ii) Removal of accessory units for examination, adjustment or repair.

An Air Engineer, Category "D", is authorized to certify as airworthy, after major repairs and/or complete overhaul, any engines of the types endorsed on his Certificate, provided:—

(a) That replacement parts conform in all respects to the manufacturer's approved drawings for such parts.

(b) That reasonable precautions against failure of any part has been taken by means of adequate inspection.

(c) That no modifications have been made or added except as ordered by the Minister in Technical Information Circulars, or otherwise approved by him.

(d) That he is satisfied by adequate and personal inspection, that the engine has been correctly assembled, including the installation or insertion of all necessary locking devices as will prevent the accidental separation or derangement of any of the components.

(e) That the satisfactory functioning of the assembled engine and its essential accessories has been proved by adequate ground test.

(f) That the protection against deterioration is reasonable, having in mind the particular conditions under which the engine is required or expected to operate.

Period of Validity

Certificates are issued for a period of three years.

Renewals

Applicants for renewal of Air Engineer Certificates must be prepared to produce proof to the examining official that they are in possession of a copy of all current Technical Information Circulars, and that they are familiar with same.

Technical Circulars bear a number prefixed by the letter "T" thus T/1/32, T/17/34, etc. Missing numbers may be obtained on request. Applicants must state the serial number of the last Technical Information Circular received by them.

Certificates are normally renewed for a period of three years.